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JOHN HAYS HAMMOND.

As we go to press, but unfortunately too late for publication, we have received a letter from Mr. L. B. Stillwell supporting strongly the candidacy of Mr. John Hays Hammond for the Republican vice-presidential nomination. This journal has no politics,. but we venture to express the belief that the view taken by Mr. Stillwell as to the desirability of such a candidature will have the general approval of every engineer. There is no political office in this Republic for which a competent engineer accustomed to public life should not be willing to stand. It is to be remembered that the greatest of our presidents was a civil engineer. There are two points, however, that are incidental but important. One is the possible succession to the presidency, a place requiring the best energies of a vigorous man in the best of health. The other is the fact that the United States Senate, while one of the most notable deliberative bodies in the world, does not exact from its presiding officer the full exertion of all his powers. An engineer of the distinction and executive ability of Dr. Hammond might serve his country to better advantage in an active cabinet position.

THE WESTINGHOUSE SITUATION.

It is seriously to be regretted that the apparent apathy on the part of some of the stockholders of the Westinghouse Electric & Manufacturing Company should imperil the plan of reorganization proposed by the Merchandise Creditors' Committee and noted several times in our pages. If industrial and electrical conditions were bad without hope of improvement we could understand this seeming reluctance to give the company the capital necessary for a safe development and steady continuance of its great business; but all the signs to-day are of recovery and returning prosperity. What the Westinghouse system can do in normal times is a matter of record; while the field of electrical construction and consumption grows yearly and is rapidly reaching its old level as a new starting point. But with the Westinghouse system, like any other, reduced to a group of factory buildings—mere bricks and steel—its goodwill gone, its patents invaded, and its superb organization scattered, the stockholders would receive the barest fraction of the value that now inheres in the company's assets. The situation is one that affects the electrical industry as a whole, and it is to be devoutly hoped that the stockholders, like prudent men, will unanimously decide to conserve that which is now theirs and is tangible, rather than permit it to melt away, with universal loss.

UNDERWRITERS' ELECTRICAL INSPECTION.

That the old-time prejudice against underwriters' electrical inspection has not abated in some parts of the country, is evident from a letter on the subject printed elsewhere. That underwriters' inspectors and electrical men having to do with

installation work will ever become brothers in feeling is a dream that will always lack realization. Assuming that absolute perfection resided with the former, and that self-interest should impel the latter to accept the National Electrical Code as a blessing even though in disguise, a certain principle of human nature, and particularly of American human nature, would prevent close communion. That is to say, the average human being resents interference with the details of his business by any person or interest whose status in such interference is not absolutely tangible. While a certain amount of friction due to this feeling will therefore probably always affect the relations of underwriters' inspectors and those engaged in installation work, there is very little, if any, excuse for the attitude of deliberate hostility which in some quarters is yet maintained against underwriters' electrical inspection. Leaving aside the right of underwriters to protect their monetary interest by refusing insurance when a property does not conform to their ideas of a safe risk, it should always be borne in mind that the rules to which risks are required to conform are not a code in the compilation of which the electrical interests concerned have been deliberately ignored. On the contrary, the code, when put in its present form in 1897, was approved by a conference at which no less than a dozen engineering and industrial national bodies were represented, including the American Institute of Electrical Engineers, the National Electric Light Association and the National Electrical Contractors' Association. Moreover, at a similar conference held annually, proposed additions to, or amendments of, the code are submitted for discussion prior to their adoption. While there is not always unanimity in the approval of more stringent requirements added to the code, yet the representatives of the various national bodies are allowed an opportunity for their discussion, and almost invariably when criticism against a proposed rule is strong, it is either withdrawn or amended to obviate the objections offered. In view of this co-operation of electrical bodies in the formulation of the code and the part which they play in its amendment from time to time, any requirement which is thought to bear unduly against the electrical interest should rather be brought to the attention of one or more of these bodies than furnish a cause for hostility against underwriters' electrical inspection in general. We have several times recently pointed out the great benefit to the central-station industry from careful inspection of electrical installations, and shall not here dwell upon this side of the question.

Induction Coils for Gas Ignition.

The ordinary spark coil for igniting gas in the household burner, the automobile engine, or the boat engine, is one of the most generally used electrical devices. It is very simple in construction as well as reliable in action, and yet it has remained but little understood in quantitative detail by engineers, although its general principles of action were established by Faraday, Henry and many other experimentalists. The working formulas of the spark coil have been conspicuously absent in text-books of electromagnetic machinery, whereas the working formulas of its cousin, the alternating-current transformer, have long occupied niches in text-book literature. The principal reason for the scant treatment of the spark coil has been the troublesome and irregular electric resistance of the spark gap. The excellent work of Prof. F. W. Springer has recently added largely to our knowledge of the subject, and a paper by Mr. Beni. F. Bailey, in the *Physical Review*, on "Induction Coils," makes another stride toward filling the gap in our formulas. The paper by Mr. Bailey does not deal with the subject so much from a mathematical standpoint as from an experimental standpoint, by supplying records of tests made on spark-coils under fairly practical conditions. The method of observation described was virtually the potentiometer method of operating a revolving contact maker, on the shaft of a rotating circuit closer and opener. Consequently, although tedious to work with, it absorbs no appreciable energy from the coil under test.

The article brings out a number of useful facts that, if duly confirmed, cannot be too widely disseminated. In the first place, spark coils, when operated with a secondary winding, commonly develop an efficiency of 50 per cent. When operated without any secondary winding, the efficiency may go up to 80 per cent, or even more. These are surprisingly high figures for the efficiency of so misused and crudely designed instruments as spark-coils commonly are. At the same time, we must remember that the tests reported were made under laboratory conditions, and we must not be distressed if efficiencies in the every-day use of grimy and dust-laden automobile ignition instruments should be found much lower. Another interesting fact is that not only does the current strength in a coil without secondary winding rise nearly on a straight line, if the period of make is properly short, but the fall of current during breaking appears to be substantially along a straight line when plotted against time. The time of making contact may be 1/30 of a second, and the current may rise at a nearly uniform rate of over 50 amp per second during this time. The time of breaking contact, and of sparking at this contact, may last 1/300 second, and the current may fall at a nearly uniform rate of over 500 amp per second during this interval. The important point brought out is that although the resistance of the spark at the break increases with the time or with the length of the gap in a complex manner, the current through it subsides nearly according to a straight-line law. The maximum e.m.f. across the gap appears in different coils, with different speeds of breaking, to have reached maxima from 25 to 70 volts, or about the voltage of ordinary arc-lamps. The maximum external power reached from 20 to 30 watts. It is suggested in the paper that proper ignition depends more on the maximum watts in the spark than on the total energy in the spark. Here lies a good field for future investigation.

When a secondary winding is used on the induction coil, the primary spark-gap is ordinarily shunted by a condenser. This condenser plays an important part in the proceedings. It absorbs the magnetic energy in the coil as electric energy, and commonly liberates that energy in an oscillatory discharge if the secondary coil is not too heavily loaded. In such a case the coil acts as a converter from direct to alternating currents, the frequency of the alternating current being 800 cycles per second in one case analyzed. The efficiency of the coil and the magnitude of the maximum induced e.m.f. depend upon the capacity of the condenser. The best condenser for these purposes is usually not the best from the standpoint of suppressing sparking at the primary gap, so that a compromise capacity has to be adopted. With a condenser in the primary circuit, the ohmic resistance of the primary coil, if no greater than occurs in practice, has only a modifying influence. The surge-resistance $\sqrt{L/C}$ of the primary circuit is the controlling factor. The maximum voltage across the primary gap is the primary cur-

rent strength at breaking, multiplied by this surge-resistance. The maximum secondary voltage on open circuit will be this voltage multiplied by the ratio of transformation. The induction coil in any form is a device for storing energy temporarily in the magnetic form, this magnetic energy disappearing from the primary electric circuit. On magnetic discharge, the magnetic energy is thrown into a spark-gap or into a secondary circuit, after paying for certain losses, namely, core-losses, copper-losses and spark-gap losses. The eddy-current losses in the core are apt to be large, owing to the high secondary frequency, unless the core be very finely divided. High induction-coil efficiency requires, therefore, a relatively large magnetic energy, and relatively small losses in storing and releasing it.

THE MISSED OPPORTUNITY.

Doubtless one of the interesting features of a transatlantic voyage is the frequent announcement of communication established with one ship or another or with a shore station. It should give one a curious sensation at first to know that 300 or 400 miles away the sounder clicks responsive to the messages shot from the ship's antennæ, but the feeling of wonder cannot but give way to a certain sense of keen regret that the tremendous possibilities of wireless are, in fact, bent, so far as general service is concerned, to relatively non-important uses. The navies of the world have probably pushed wireless telegraphy further ahead than any of the commercial operators, yet aside from this one must regretfully own that wireless service is rather trivial. One may perhaps get small personal messages, or learn from the bulletin that Snobsbury, poly-millionaire in pork, has passed to his somewhat dubious reward, and that three widows are contesting his estate. There seems as yet to have been nothing like a determined effort to work wireless for what it is worth, making it thoroughly useful to the navigator and valuable to the traveler by sea. Nobody seems to know just what the wireless situation is as regards working range of action, or if anyone does actually know he is keeping wonderfully silent about it. We have wonderful tales, doubtless quite correct, of messages steadily received over many hundred miles and even quite across the Atlantic, but we do not hear of the apparently frequent failures to span much shorter distances, and know little or nothing about the difficulties encountered and to be overcome. Syntonic sending and receiving has been promised so often that it has come to be a joke, yet every chap who tries it is more than likely to be the victim of such pranks as brought to unseemly merriment not long ago a solemn lecture by one of the distinguished founders of the art. It seems to be one of the cases where the immense possibilities of a more or less distant future have quite overshadowed a really great and immediate use for the present.

Perhaps when there is less selling of stock and more sending of messages on a purely commercial basis, one may expect a more serious and regular use of wireless for practical purposes. Even granting that sending long-distance messages over land will remain the failure that it has been thus far, there is still a very wide scope for usefulness that should not longer be neglected. The first definite thing to which steady attention should be directed is the conquest of the traveled high seas. This should be undertaken by international action, like all the large uses of wireless, since only thus can work upon the high seas be carried out upon a clear and uniform plan. The definite purpose in view should be to put the whole North Atlantic, as a start, under a wireless network capable of maintaining permanent and complete intercommunication. There are effective stations in the region now, but not enough or with sufficient power to do the full work. The stations on the Irish Coast and on Cape Race are good enough, but they need reinforcement. The Azores should be utilized for a powerful plant, backed up by another on the French coast and others on Bermuda, the Lesser Antilles, the Canaries and Madeira. Were such a chain of stations as this properly equipped there should not be a square mile of the traveled Atlantic out of their reach. Even without increase of the present radii of action, the ocean could thus be covered for sending purposes with the utmost ease, and the same stations should be able to pick up messages over almost equivalent radii. The next step would naturally be to fit out some of the big liners with extra powerful apparatus and the longest feasible antennæ to serve as temporary intermediaries pending the time when all steamers may carry equipment enough to keep continually in touch with a shore station. This done, it could be made practically certain that no steamer having a wireless installation would ever be out of touch with a station afloat or ashore. The shore stations relaying with each other could even now be sure of complete intercommunication, so that any suitably equipped ship could at all times send and receive messages from shore to shore. Even at present the big liners are now and then lucky enough to pick up one shore 'ere losing the other, but more stations are needed to make things absolutely sure.

This done, one of the first matters of importance is to establish a complete wireless weather service so that any equipped vessel might know with a reasonable degree of certainty the weather to be expected during the next day or two and make plans accordingly. As it now is, no one can predict the weather a day and, say, 500 miles ahead, but with a full series of wireless reports the conditions could be predicted with more precision than is possible ashore, since in the great level of the open sea there are fewer local disturbing factors than are found ashore. With such information at hand the transatlantic schedule could be held almost to an hour, barring failure of the machinery, and some dangers could be averted by accurate knowledge of the position of serious storm centers. This knowledge is even now almost within reach and can be attained by a little systematic extension of work at present going on. Steamers crippled and in need of assistance could make their condition known even if storm-driven far out of the usual path, whereas there is a capital chance of their being out of reach. In fact, wireless working under existing conditions just misses a magnificent chance for usefulness. Its reach is not quite long or sure enough to span the distances now necessary, and its application lacks the systematic character that can be given only by unified effort and, for that matter, unified control. It is too much of a plaything and too little of a serious reliance. We mentioned some time since the plans being made for distribution of time by wireless and the important benefits that might be derived from it—important even if its full possibilities cannot yet be realized. All this is eminently proper matter for international effort, which seems in the case of wireless telegraphy to be particularly appropriate. It is perfectly safe to say that no considerable part of the possible benefits can be realized by private effort. One might as well pin one's faith to a lighthouse corporation instead of trusting such work to the government.

Appraisal of New York City Traction Properties.

The Public Service Commission for New York City has determined to definitely test the limits of its authority over the traction lines of New York City which are now in the hands of receivers. The commission has adopted a resolution ordering an appraisal of all the property of the street railway companies of Manhattan. This action is a result of the statement of the receivers of the New York City Railway Company that it could not provide what the commission ordered and defined as adequate service without defaulting on the rentals of many leased lines.

The commission takes the position that it is obligated under the law to see that an adequate service is maintained, and that if the lines cannot provide such service with their present fixed charges, a readjustment is necessary upon a basis of actual values. It is the position of the commission that the capitalization of the various surface properties in Manhattan, about $250,000,000, is excessive, and that the necessity for earning an adequate return upon this capitalization cannot, in justice, be pleaded as an excuse for not furnishing the public with sufficient service.

Chairman William R. Willcox, of the commission, made the following statement of the reasons for an appraisal:

"The directions of the commission for adequacy will be insisted upon, for it is time to have it thoroughly settled whether a mismanaged local public service corporation can escape the obligations placed on it by the laws of the State when it throws itself into the hands of receivers appointed by any court. If such action on the part of such corporation relieves it from the operation of the laws of the State and thus constitutes an immunity in so far as the operation of the statutes is concerned, the sooner it is known the better. The letters sent by the receivers to the commission seem to indicate that the first object of the receiver is to pay rentals of leased lines and other fixed charges. This idea is a mistaken one. The obligation resting upon those enjoying public franchises is primarily to give an adequate service, and it is to be regretted that the importance of serving the public is not considered at least equal with that of serving the stockholders. The commission has ordered that adequate service shall be furnished under the four orders issued. No objection has been made by the receivers to the definition of adequate service which the commission has adopted, and the only excuse that has been offered is that the fixed charges will not permit the expenditure to give an adequate service to the people, and an implication is made that if adequate service is insisted upon the system will be disintegrated and transfers from one line to another therefore refused.

"The law empowers this commission to regulate rates of fares between companies and to provide for continuous rides by transfers between two or more lines. Manifestly it cannot fix rates or take action compelling the issuance of transfers, or arrange for a joint rate, until it knows the value of the company's property."

The resolution adopted by the commission is as follows:

"Whereas, The receivers of the New York City Railway Company have stated to the commission that it is impossible for them to provide adequate service upon the street-car lines in Manhattan because there would not be sufficient funds to pay the rentals of many leased lines if the service were made adequate; and,

"Whereas, The investigation made into the books of this company and its subsidiary companies last fall indicated in certain instances that the companies were greatly overcapitalized and that the rentals being paid were out of proportion to the value of the lines; and,

"Whereas, Thousands of citizens of New York will be seriously inconvenienced by the abolition of transfers by the receivers; and,

"Whereas, It has been asserted that if a fair rental were paid to the subsidiary companies, based upon a fair value of their property, the company could give adequate service and retain a satisfactory system of transfers; and,

"Whereas, These questions raised by the action of the receivers cannot be definitely answered without a knowledge of the value of the property of each line as one factor; therefore be it

"Resolved, That the commission proceed to inventory and appraise the property, tangible and intangible, of the street-railway companies in the Borough of Manhattan and that the chairman have general direction of the work."

Mr. Willcox says that the appraisal will be made under the direction of the best experts it is possible to employ in the country.

After the decision to make an appraisal was announced, the receivers of the New York City Railway Company issued a statement in which they said:

"The action of the commission in voting to inquire into the value of the street-railway properties in Manhattan before issuing any further orders for increase of service commends itself to the judgment of the receivers. We do not wish to be understood as having any purpose to defy the commission or to enter into any controversy with that body."

The total fixed charges on which defaults have so far been made on mortgages and rentals of the Metropolitan Street Railway Company, the Third Avenue Railroad Company, the Central Crosstown Railroad Company and the Fulton Street Railroad Company is $7,751,308. Should the federal court also act favorably on the application to discontinue the operation of the Central Park, North & East River Railroad Company and the Twenty-eighth & Twenty-ninth Streets Crosstown Railroad Company, this figure will be increased to $7,988,308.

The statement includes that no more fixed charges can be eliminated without default on the interest on securities of underlying companies, which would mean the disintegration of the entire system and entail a serious curtailment in the present transfer privileges.

Hearing on New York Electric Lighting Contracts.

At the investigation of the electric light service of New York by the Public Service Commission, Mr. Arthur Williams, general inspector of the New York Edison Company, was again examined June 11. Mr. Williams said that as far as he knew the Edison Company had never had more than 75 or 80 special contracts with customers, and that all of those were inherited from other companies. Mr. Williams was then examined at length with reference to the various riders attached to special contracts, the commission seeking to know in regard to every one of them what objections, if any, there were to making public their provisions and giving every consumer an opportunity to avail himself of them. Speaking of the rider obligating the consumer to contract for a period of six years and to agree not to put in a private plant, Mr. Williams said that the private plant clause was considered important, and as it affected owners and lessees of buildings and not sub-tenants, it was to that extent a provision which could not go in the standard form of contract. The same rider which accompanied a concession in rate to from 3 to 5 cents per kw-hour was held by Mr. Williams to be impractical for small consumers in an apartment, because the company could not accept their guarantee as to the use of their proportionate share.

Mr. Williams admitted that the main considerations for making concessions were to keep out private plants, to guarantee a large consumption and to have the right to put in a small local station within the building rent free. Mr. Williams stated that a blank space was left in all wholesale contracts in which special conditions could be written to conform with the circumstances attending the contract, but said that similar conditions would apply to all consumers under similar circumstances. In reponse to Commissioner Maltbie's insistence that all possible conditions should be made known to every prospective cus-

tomer, Mr. Williams said that the company considered every case individually, and he doubted if it would be practical to make in advance a statement that would cover all conditions. Mr. Williams explained that there were sometimes clauses inserted requiring weekly payments on account, which was not a special concession, but simply a matter of protection to the company where it did not care to extend its credit for a larger amount. One of the special clauses inserted in wholesale contracts provided for the purchase of incandescent lamps in use in the installation when the contract was made, at 7½ cents each, and that in consideration of supplying lamps and supplying carbons and attention for incandescent lamps, a concession of 1 cent per kw-hour would be made. After hearing Mr. Williams upon all the riders in detail, Commissioner Maltbie expressed the opinion that the company could not too speedily make public all its forms of contract, conditions of service or special riders, so that any prospective consumer would have an opportunity to take advantage of them. The hearing was adjourned until June 15.

At the hearing on June 15, Mr. Williams was again on the stand to give further information concerning the wholesale contracts of the company. He stated that when a reduced rate was granted under a 2000 kw-hour per month contract, with a two-hour daily consumption, this quantity was charged against the consumer whether he used it or not. In the matter of discounts Mr. Williams said that in these wholesale contracts, when the bill amounted to $500 per month, 5 per cent was allowed, and when it reached $1000 per month, 10 per cent was allowed. Mr. Williams added that the company will terminate all of its wholesale contracts July 1, as it contemplated furnishing only one form, which would save these complications and give all customers equal opportunities. Commissioner Maltbie announced that with the understanding that the company was at work upon a uniform contract inquiry into that subject would be discontinued.

Mr. John W. Lieb, for the Edison Company, testified as to the difference in contract rates in Manhattan and in the Bronx and explained that it was due to the different character of territory and different classes of consumers. Mr. Lieb also explained that to serve one large building as a unit was cheaper than to serve six smaller ones, even though located closely together, and consuming the same amount of electricity. The hearing was adjourned until June 17.

Inspection of Niagara Power Tunnel.

The wheelpits and tunnel tailrace of the Niagara Falls Power Company underwent a thorough inspection on Sunday, June 14, and were found in almost perfect condition. This is the first inspection made since June 1, 1902, and after this lapse of six years the great underground work of the Niagara power development appears as substantial as ever. The tunnel inspection was made possible through the fact that the International Railway Company desired to have the tunnel flow shut off long enough to inspect the north abutment of the upper steel-arch bridge on the American side of the river, this abutment having a retaining wall to protect it from the torrent that pours out of the tunnel.

The water was shut off at 1 a. m., Sunday. The gates and valves worked nicely. Before 2 a. m. engineers were in the tunnel making their examination. Every part was gone over, and with the sole exception of a few bricks out of the roof of the connecting tunnel between the wheelpits, everything was found in perfect condition. A. H. Van Cleve, consulting engineer, was in charge of the engineering inspection, while Mr. C. C. Egbert, mechanical superintendent, made a full inspection of the mechanical features of the two great installations.

The International Railway Company had a force of men, including three divers, ready to make an inspection of the abutment, and as soon as it was light enough this work began. The result was that it was found that the retaining protective wall had not protected the abutment as intended, but that the water had succeeded in washing away the shale back of it. The damage was not so great as was expected it might be, and repairs will now be made, guided by the knowledge the inspection has afforded.

In order that a Lake Survey Corps might secure data as to the normal flow of the American channel and falls during the time when no water was being diverted, the Niagara Falls Hydraulic Power & Manufacturing Company also shut down its works. Thus for a few hours no water was being diverted at Niagara Falls, N. Y., for power development. Mr. Francis C. Shenehon, of the Lake Survey Corps, had men stationed at the river's entrance, near Buffalo; at Schlosser Dock, Port Day, Willow Island and Prospect Point, Niagara Falls, who took levels during the continuance of the shutdown and after the turbines were again in operation. The conditions under which these levels were taken were understood to be very pleasing, and it is said the level at Prospect Point, the brink of the American Falls, showed an increased depth of 1 1/5 in., but this is not definite information.

Major W. C. Kutz, of the Taft Scenic Commission; Secretary W. E. Wilson, of the International Waterways Commission; Dr. E. W. Schoder, of Cornell University; Mr. A. Monro Grier, Mayor A. C. Douglass, Mr. W. S. Humbert and General Manager Philip P. Barton, of the Niagara Falls Power Company, as well as others, made a trip through the tunnel.

Convention of the National Electrical Trade Association.

The annual convention of the National Electrical Trade Association was held in Philadelphia, Thursday, June 11, at the Manufacturers' Club. Twenty-five members were in attendance and after transacting the business brought before the meeting and electing officers, the Philadelphia members entertained the visiting members by a trip to Atlantic City. The following officers were elected:

President, Mr. Charles M. Wilkins, of Partrick, Carter & Wilkins; vice-president, Mr. Norman Marshall, of the Marshall Electric Manufacturing Company; secretary-treasurer and counsel, Mr. Fredrick P. Vose, Chicago. Four delegates: Mr. Norman Marshall, representing the New England Association; Mr. Charles M. Wilkins, representing the Philadelphia Association; Mr. John H. Dale, representing the New York Society; Mr. James F. Wolff, representing the Chicago Association.

New Quarters for Chicago Engineering Meetings.

The numerous engineers in Chicago and vicinity who have been attending engineering meetings of various kinds, most of which have been held in the rooms of the Western Society of Engineers on the seventeenth floor of the Monadnock Block, are interested in the important changes which will take place the coming summer in the rooms of that society. The new quarters will occupy the entire north part of the seventeenth floor of the Monadnock Block, occupying a space 62 ft. x 61½ ft. The library, reading room, secretary's office and committee rooms occupy the outer portions of this space. The inner portion, 36 ft. x 44 ft., will be an auditorium protected by the outer offices from the noise of the street, which have been very annoying in the old quarters. This room will have a seating capacity of 162, which can be somewhat increased in emergencies. This room is 14 ft. high and is provided with a skylight and provisions for artificial ventilation. The inability to secure proper ventilation has been one of the greatest drawbacks to the old quarters, and at times has interfered seriously with the attendance and interest at meetings. It is expected that the new quarters will be ready in time for the first engineering meetings in the fall. Both the Western Society of Engineers and the Chicago branch of the American Institute of Electrical Engineers hold meetings in these quarters.

Illinois Frontage-Consent Law May Be Unconstitutional.

A decision of much interest to electric-lighting companies in the State of Illinois, and indirectly to those of other States, was given out June 9 by Master in Chancery Zeisler. in Chicago, regarding the law requiring the consent of a majority of the property holders on a street to the construction of pole lines or conduits for electric-light wires. In 1897 the State Legislature of Illinois enacted a law requiring that the majority of the property holders on any mile of street or roadway be obtained before the City Council or Board of Trustees could legally grant a franchise for the construction of a pole or conduit line for electric-light wires. In Chicago the board of trustees of the sanitary district, a public body which controls the Chicago drainage canal and the electric power generated by the canal, attempted to build pole lines in the streets of Chicago without obtaining the consent of property owners. The law specifies persons or corporations. The sanitary district trustees held that a public body created by the people would not come under a law applying to persons or corporations. The case was tried before Master in Chancery Zeisler in a suit filed before Judge Carpenter by real estate owners. The master in chancery not only held that frontage consents were unnecessary because the board already had a grant from the State of Illinois, but went further and held that the frontage-consent law was unconstitutional and void because it applies only to electric-light companies and not to other companies transmitting electricity. His decision applying to the constitutionality of the act is as follows:

"I find that whatever danger to life and property may arise from the presence of any electric wires in or under a street does not affect abutting property holders as such, but affects to an equal degree all those who have occasion to use the street; in other words, the general public. Apart from the fact that electric-light wires are thicker than telephone, telegraph and alarm signal wires, there is no material difference in the appearance or general method of construction of the different transmission lines.

"The construction or maintenance of an overhead transmission wire for lighting purposes is not more unsightly nor in other respects more burdensome to abutting property holders than that of an overhead transmission line for any other purpose.

"The legislative purpose of the frontage-consent act of 1897 manifestly was not to protect the general public against the danger arising from the presence of electric wires in or under the streets because it gives a practical veto power only to abutters, and because the same act requires frontage consent for the laying of gas pipes in the street, and there is no pretense that the construction or maintenance of a gas-pipe line endangers abutting property holders. Manifestly, therefore, the only purpose was to afford protection to abutting property holders (as distinguished from the general public) against the inconvenience arising from the tearing up of streets, the possible depreciation of their property or the offense to their aesthetic sense arising from the maintenance of pole lines in front of their property.

"The fact that lighting wires are more dangerous than other wires to those who come in contact with them bears no relation to this legislative purpose, and there is no fair reason for requiring the consent of frontage owners for their construction, which would not require with equal force the extension of this provision for the construction of transmission lines for other purposes. The frontage-consent act, so far as it applies to electrical transmission lines, violates both the State and the federal constitutions and is therefore void. The question whether it is also void so far as it applies to the laying of gas pipe in the streets, does not arise in this case, and I, therefore, express no opinion thereon."

This ruling of the master in chancery is yet to be passed upon by Judge Carpenter. This decision will help to settle the controversy between the city of Chicago and the sanitary district trustees as to the rights of the sanitary district pole lines in the streets of Chicago. The City Council of Chicago, at its meeting June 8, also passed an order that the sanitary district be allowed to run wires on poles and in conduits belonging to the city under the approval of the city electrician, with compensation to be agreed upon in each case.

Lighting Questions in New York.

On Thursday evening, June 11, the regular monthly meeting of the contract and inspection department of the New York Edison Company was held in the Edison Auditorium. Several very interesting and instructive papers were read by members of the department, including "The Public Utilities Company's Dealing with the Public," by Walter Neumuller; "Electric Signs," by E. A. Mills; "A Few Thoughts Concerning the Competition of the Local Plant," by W. H. Whitton; "Work of the District Offices," by F. H. Kinnicut; "The Tungsten Lamp," by E. F. Tweedy. At the conclusion of Mr. Tweedy's paper several lantern slides were shown giving the performance of the tungsten lamp, followed by views of lighting fixtures adapted for use with tungsten lamps, which were described by Mr. Mills.

Mr. Arthur Williams, general inspector, closed the meeting with a timely address on the activities of the department in the past and present, with suggestions for work in the future.

Investigation of Telegraph and Telephone Companies.

During the closing hours of the last session of Congress a resolution was passed by the Senate which called on the Secretary of Commerce and Labor for an investigation of telegraph and telephone companies. The resolution follows: "That the Secretary of the Department of Commerce and Labor be, and he is hereby, directed to institute an investigation into all the telegraph and telephone companies engaged in the conduct of an interstate business as to the methods used in handling the public's business, the wages paid to telegraphers, telephone operators and other employees of such companies and the working conditions of the employees thereof, together with a statement of the receipts and expenditures of such companies for a period of five years. And he is further directed to report the results of such investigation to the Senate on the first Monday in December, 1908." In compliance with this resolution Secretary Straus has instructed Commissioner Charles P. Neill, of the Bureau of Labor, to conduct the inquiry and to have his report ready before Congress convenes.

Illumination and the Eye.

Dr. Henry Gradle, of Chicago, addressed the Chicago section of the Illuminating Engineering Society, June 11, on "Illumination and the Eye." He took up mainly the effects of varying degrees of illumination on the eye and showed that what the eye considers good illumination is, within certain limits, largely a matter of comparison or contrast. The eye can work comfortably within great ranges of illumination, but after being exposed to very high illumination, such as sunlight, considerable time is required to adapt it to seeing most clearly where the illumination is less. In the discussion it was brought out that the eye normally in daylight receives a certain amount of light from every direction. If we change these conditions with artificial light, it is most trying on the eyes. For example, a person when sitting in a comparatively dark place and looking toward a place more brilliantly lighted with exposed lamps suffers great eye fatigue. A practical example of this was afforded by the accidental extinguishing of the lamps at one end of the meeting room during the meeting, thus causing considerable eye discomfort to those sitting in the dark end of the room looking toward the lighted end. In theaters the darkening of the audience room, Dr. Gradle pointed out, had the effect of making the audience perceive things on the stage more clearly than if some of the general lighting of the audience room was continued during the performance.

Progress of Denver Gas & Electric Co.

During the past year the Denver Gas & Electric Company has installed two turbo-generators of 3000-kw and 2250-kw capacity respectively, and a De Laval turbine of 225 hp. Thirty-one miles of pole line have been erected and substations have been electrically connected in a manner to make them interchangeable in case of breakdowns. The transformer capacity has been increased by 2185 kw, and 3320 electric meters were purchased. The increase in sales for the year ending May 1 was 4,559,755 kw-hours, or a gain of 21.7 per cent in quantity and 14.8 per cent in gross receipts. The lesser increase of gross receipts is due to reduction in the rates made to conform to a franchise ordinance which provides that after Jan. 1, 1908, the average of receipts from sale of current shall not exceed 7.1 cents per kw-hour. During the past year special effort has been made to secure additional local stockholders in order to increase local interest in the property. On May 1, 1907, only 81 stockholders were residents of Denver, while on May 1 of the present year this number had been increased to 295. No less than 145 employees of the company are now stockholders. The payment of dividends of one-half of one per cent on the first of each month has done much to create an interest and demand for the stock locally. The annual report of the company states that Denver now enjoys the reputation of having the best lighted business section in the country, and that with the increase in private lighting has come a demand for additional public lighting, which was shown in the recent installation of ornamental street lighting on one of the main streets, and plans for increased lighting on another important street. The city has also added to its street lights in the residential section.

Last year the number of electric consumers was 21,140, an increase of 3150; the number of 16-cp lamps connected, 360,300, an increase of 36,343; kw-hours sold for the year, 25,531,451, an increase of 4,559,755; the number of arc lamps in use, 3,193, an increase of 574; the number of electric signs connected, 291, an increase of 125; the number of 50-cp street lamps connected, 693, an increase of 137; the number of motors connected, 1913, an increase of 191; horse-power of motors connected, 11,291, an increase of 606 hp.

Commencement at Worcester Polytechnic Institute.

The thirty-eighth annual commencement exercises of the Worcester Polytechnic Institute were held on June 11 in Tuckeman Hall, Worcester. A class of 71 men were graduated, of whom 23 were electrical engineering students. Eleven graduate students and engineers received the degree of E. E. The commencement speaker was the Hon. James Logan, Mayor of Worcester, and general manager of the United States Envelope Company, his subject being "Changing Industrial Conditions."

Mayor Logan reviewed the development of modern industry since the Civil War period, stating that one result of the conflict was the speeding up of all productive machinery. Between 1836 and 1861 the Patent Office issued 32,291 patents; from 1861 to 1865, 22,667 patents, and from 1865 to 1907 there were issued 823,894 patents, or a yearly average practically as large as that of 1861-65. The expiration of fundamental patents greatly stimulated minor inventions and applications. The speaker then emphasized the importance of management, and particularly accounting in the industrial work of the times. The management of the large corporation is to do for the industry what the inventor has done with machinery; for, after all, a machine is simply organized thought, and while no patents are granted for improvements in management, there are as real inventions in that field as in the mechanic arts. We have standardized methods and machines, but we never can standardize human beings. The individual equation must always be considered, and the rank and file do not take orders as they once did.

In industry, as in war, the fighting formation has been changed. Modern methods have abolished the idea that men must be mere machines. The officers are no longer able to control their men as formerly, because the fighting formation covers so much ground, and, therefore, the men in the ranks must have a higher standard of industrial intelligence. Successful industry requires, as never before, genius in organization, and the leader must be a constructive statesman in industry, capable of formulating large and far-reaching policies. Men may criticise and abuse Rockefeller and Carnegie, but when time, the great softener, has done its beneficent work, and we can get the proper perspective, the world will note and give credit to these men for bringing the organization of business to a scientific basis. Notwithstanding its defects the modern factory system has been one of the mightiest instruments of civilization. The corporation is to be the machine for bringing in the shorter working day for the laboring man.

One of the secrets of Andrew Carnegie's success was his accounting system. The cost of running one accounting room of his Pittsburg plant was $80,000 a year, but Mr. Carnegie said it was worth all it cost, for it gave him the inside details of his business. Gov. Hughes' successful penetration to the very center of the dark continent of high finance was in considerable part due to his knowledge of accounts. More and more the accountant is to be the prime factor in the development of industrial efficiency, and the engineer should know something about accounting, since his own success or failure may be determined in the office instead of the field.

The annual engineering lecture was delivered at the institute on June 9 by Prof. George I. Rockwood, who gave an illustrated review of modern steam turbine development, with a discussion of the advantages and disadvantages of the different types.

Electrical Development at Rome, Italy.

It is proposed to make additions shortly to the electrical supply of Rome, Italy, which will aggregate an expenditure of nearly $4,000,000. These include a large steam generating power plant outside Porta S. Paolo, on the Tiber, to give an additional 30,000 kw, which, with the 15,000 kw available from the Aniene and Nera, will make the total extra supply 45,000 kw. Only the Aniene plant—giving 5,000 kw normal and 6,500 kw maximum, and a steam central station, giving 7,500 kw normal, and 10,000 kw maximum—will be built at present, the Nera hydro-electric plant and the extension of the steam central station to supply an additional 20,000 kw being left for further consideration, when the extending of the city and the rapid increase of population will make a larger supply of power necessary.

The main features of the central hydro-electric power plant on the Aniene include a canal some 8.4 miles long (including a tunnel 1.16 miles long) to carry 460 to 530 cu. ft. of water per second, and giving a fall of some 202 ft. There will be four generating sets, each consisting of one hydraulic turbine, giving 2,600 hp, normal, at a speed of 500 r.p.m., and 3,100 hp maximum direct coupled to a three-phase alternator, developing normally 1,800 kw at 6,000-6,500 volts, at a frequency of 50 periods. There will be four three-phase transformers, submerged in oil, water cooled, which will raise the voltage from 6,000 volts to 30,000 volts, the voltage on the transmitting line.

The transmitting line, 23.5 miles long from the hydraulic central to the receiving substation in Rome, will consist of two groups of three wires each, the section of the wires being such that in case of accident on the line the current may be transmitted to Rome by one group only. The wires will be supported by iron poles of the rigid type on the mountain sections and on the "Semenza" or elastic system in the plain, the two groups of wires being placed some 7 ft. apart.

The receiving substation in Rome, to be situated adjacent to the central steam station, will have four transformers, oil insulated and water cooled, reducing from 30,000-32,000 volts to 6,000-6,330 volts. The steam generating power station plans will include eight boilers of the multitubular type, with stokers, economizers, feeding pumps, etc. There will be four turbo-generating sets, each consisting of a steam turbine direct

coupled to a three-phase alternator, each group to give 2,500 kw, normal, at a speed of 1,500 r.p.m.

The main distributing system will consist of eight cables, aggregating a length of 56.5 miles. The secondary distributing system will extend practically over the whole area of the town. A considerable number of Nernst lamps (1,650) and metallic filament lamps, 100 and 60 cp, will be employed for lighting streets and narrow thoroughfares.

The total cost of the plant and distributing system has been estimated at $3,706,000, of which $752,000 is allocated for the hydraulic works and central hydro-electric station on the Aniene, $144,000 for the transmitting line, $700,000 for the central steam generating power station, and $1,300,000 for the main and secondary distributing system in town.

For the further extension, which is contemplated, of the steam central station (to give an additional 20,000 kw) there are to be installed four turbo-generating sets, each of 5,000 kw. The technical part of the work is under the supervision of Signor Giorgi, municipal electrical engineer.

Industrial Uses of Ozone.

At the May meeting of the Faraday Society (London), Mr. F. Mollwo Perkin presented a paper on the industrial uses of ozone, particularly in connection with water purification. The method used by Siemens & Halske was described in detail. The apparatus consists of two concentric electrodes, the inside one being of aluminum and the outside one of glass. The aluminum one in order to keep it cool is hollow and has water circulating through it. The external one is also kept cool by water contact, and as the water is in an iron container which is earthed, this acts as a negative pole, and, of course, water is a conductor on the high tensions which are employed. Dried air is passed up the annular space between the two electrodes, and, by means of the silent electric discharge which is there taking place, is ozonized. From the ozonizer the air passes up towers which are filled with pebbles, and over which the water trickles; by this means the water is divided up into a number of small streams, and consequently a very large surface is exposed to the action of the ozone. After the water has been thus treated it is allowed to flow into the reservoir in a series of cascades. By this means it comes in contact with the air, and any excess of oxone which may be in it is removed.

It is found that the water purified in this way becomes almost absolutely sterile, and any bacteria which may happen to remain are not of a pathogenic nature, consequently the water is absolutely safe for potable purposes. Messrs. Siemens & Halske have a large installation for dealing with water at Wiesbaden and another for purifying the water supply at Paderborn. They have also erected experimental plants in several other places. The process can be very cheaply carried out, as it does not cost more than 1/5d for every cubic meter of water which is treated. A portable plant has also been devised and is of particular use in case of war; in fact, some of them were employed in the late Russo-Japanese war. They should also be of value for other purposes—if the water supply of any town were to become contaminated with typhoid, for example.

The paper discussed other uses for ozone, including the bleaching and sterilizing of flour, a process used in a very large number of mills in Great Britain. Flour so sterilized is capable of export for long distances, and may be kept for a very long time without deterioration.

In the discussion it was suggested that a simpler method of sterilizing on a large scale was to soften the water and bring down the bacteria in the precipitated chalk. It was pointed out that water from rapidly-flowing rivers needed little further purification, and reference was made to the difficulties of removing the last traces of ozone from the sterilized water. It was stated that germs that could not easily be destroyed were, as a rule, harmless. The chairman described an ozonizing plant he had lately visited in Philadelphia, where the water purified was practically diluted sewage. This plant was capable of treating water for a population of 30,000, but occupied only 30 ft. x 50 ft. of ground, as against acres required for sand filters.

Central-Station Operating Results in Massachusetts.

The recently published report of the Massachusetts Gas and Electric Light Commission for the year ending June 30, 1907, affords scope for considerable detailed analysis of the cost and revenue of the central stations in that State. In the following discussion of some of the more important results of operation in the year covered the unit method of comparison is used in preference to the totals given in the report, which makes the relations between the various quantities more readily apprehended. Table I shows the distribution of earnings for all the private companies in the State, giving the proportion of each dollar, approximately, earned by the different classes of business.

Table I.

Commercial arc light service by contract	$0.01
Commercial incandescent service by contract	0.016
Commercial arc and incandescent service metered	0.57
Public arc light service	0.152
Public incandescent service	0.047
Sale of electric power	0.163
Sale of current to other companies	0.024
Steam heating revenue	0.004
Miscellaneous rentals, approximately	0.014
Total	$1.00

The most striking feature of these figures is the very small percentage of total business due to the sale of current for power. Practically one-sixth is due to power sales, while 57 per cent constitutes the sale of commercial arc and incandescent lighting current. Allowing that many small power users are served by incandescent circuits, it is clear that the future of the central-station power business in Masachusetts offers a notable opportunity for progressive development.

The State is pre-eminently the home of manufacturers, and except in the valleys of the Connecticut and the Merrimac, water power is not to be had in any considerable volume. Since both the central station and the steam-using manufacturer depend upon coal, the two should come together even more closely than in the past. Neither the load factor nor the efficiency of the small steam engine in the manufacturing plant can, in the majority of cases, compare with the well-organized central station, and if the disposition observed in some quarters to rest satisfied with existing business should give way to an energetic power campaign, the results ought to be satisfying to both the company and the public. These are at present doing business in a territory far below the power saturation point per capita.

Considering the length of the cold season in the latitude of Massachusetts it is surprising that so little central-station heating business is done. In this respect the central stations of the South have much to tell their Northern brethren. From the table it is clear that the sale of current on the flat-rate basis has practically died out in Massachusetts, in proportion to charges by meter.

Table II.

Coal and other fuel	$0.12
Rent of real estate used for plant	0.01
Oil and waste	0.003
Water	0.005
Station wages	0.062
Station repairs	0.004
Steam plant repairs	0.013
Electric plant repairs	0.009
Apparatus and machinery	0.005
Current bought	0.025
Wages for care of lights, meters, distribution, clerical, labor, collectors	0.028
Repairs and renewals of lines	0.05
Repairs and renewals, meters, lamps, motors	0.016
Distribution tools and appliances	0.005
Carbons	0.007
Incandescent lamps	0.025
Globes and directors' allowances	0.004
Salaries of officers	0.024
General salaries	0.038
Rent of offices separate from plant	0.002
General office expenses	0.027
Taxes	0.075
Insurance	0.014
Law expenses	0.006
Claims and bad debts	0.002
Incidental expenses	0.004
Total	$0.583

Table II shows the distribution of operating expenses per dollar earned by the private companies of the State.

The importance of the fuel question is reflected by Table II, which shows that 12 cents out of every dollar earned were expended for coal or other fuel. While station economy continues to be a matter of extreme consequence, the question of taxes is of much import. The latter exceed station wages in total amount for the State. Repairs and renewals of lines call for a substantial disbursement. Reduction of taxes is a difficult matter to bring about, but when questions of rates arise it is well to call attention to figures like these, which amounted to over $736,000. It is interesting to note that steam-plant repairs figured 1.3 cents per dollar earned, against 0.9 cent in electric-plant repairs. The total cost of operation was 58.3 per cent of the earnings.

The total kw-hours generated by the private companies of the State in the year were 193,951,433. The average cost of each unit of output was 2.94 cents, including all the items shown in Table II, excluding interest, depreciation and dividends. The average income per kw-hour generated was 5 cents.

Table III shows the tributary population, the gross earnings per capita, the population per horse-power and connected motor load, the gross earnings and the operating expenses in the systems of the 12 principal urban central stations, the companies being arranged in the order of tributary population as figured in the commission's report on the basis of the State census of 1905.

TABLE III.

Name of company by city.	Tributary Population.	Gross E'n'gs per cap.	Motor (con'd) hp.	Popul'n per connected hp.	Gross Earnings.	Approx. fr. Operating Expenses.
Boston Edison	703,597	$5.72	35,096	20	$4,024,000	$2,156,000
Worcester	128,135	2.36	1,449	88.5	303,000	154,800
Lowell	110,000	2.66	5.071	21.6	292,800	183,000
Fall River	105,762	2.32	1,048	100.5	246,000	155,600
Malden	101,129	2.34	1.285	79	236,500	152,000
Cambridge	97,434	2.88	2,411	40.3	281,000	138,000
Lawrence	89,972	2.16	1,460	61.5	194,900	115,400
Lynn	89,358	3.95	2,914	30.6	352,200	202,500
Springfield	86,486	5.19	3,692	23.4	447,700	249,900
New Bedford	78,597	1.72	553	142	135,200	72,500
Brockton	57,484	3.12	1,167	49	178,500	111,400
Boston Con. Gas	56,418	4.41	475	118	248,300	106,800

It will be seen from this table that the size of the city is small indication of the capacity of the community to absorb power. It might be expected that the resources of the largest company in the State, the Boston Edison, would permit the most thorough exploitation of the power and lighting field, but

TABLE IV.

Company.	Kw-hours, generated.	Kw-hours, sold.	Per cent loss.	Op. cost per kw-hour gen., cts.	Lb. coal per kw-hour gen., cts.	Cost distbn. kw-hour sold, cts.	Tot. cost per kw-hour sold, cts.
Boston	84,516,076	60,677,401	23.8	0.83	2.65	0.64	3.54
Worcester	5,108,527	3,994,583	19.7	1.22	3.46	1.16	3.88
Lowell	7,074,706	6,196,480	12.4	0.975	3.12	0.84	2.96
Fall River	3,953,851	3,310,677	16.3	1.4	4.	1.75	4.7
Malden	3,951,702	3,037,276	23.1	1.07	3.46	1.97	4.95
Cambridge	5,952,956	4,871,738	18.1	1.05	3.22	0.78	2.83
Lawrence	3,698,421	2,896,255	21.8	0.82	..	1.23	3.98
Lynn	8,216,268	7,183,497	12.5	1.2	..	0.92	2.82
Springfield	15,562,953	9,510,103	38.8	0.73	..	0.80	2.62
New Bedford	1,574,452	1,325,953	15.7	2.27	..	1.06	5.45
Brockton	2,831,445	2,190,222	22.6	1.87	5.6	1.55	5.1
Boston Con. Gas.	2,785,712	2,429,852	12.8	1.77	..	1.46	4.8

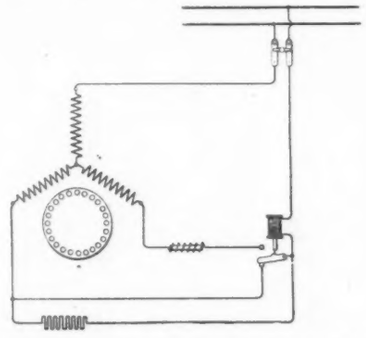
the figures for Lynn show about the same relative extent of power consumption in that city, with Springfield a close third. Lynn and Cambridge also appear to have given much attention to power business in the past few years. In gross earnings per capita Springfield follows the Boston Edison Company closely, indicating a widespread demand for electric service in that city. In considering Malden and Cambridge, it should be recalled that they are very largely inhabited by Boston business men who make their homes in these suburbs, although a considerable amount of manufacturing is scattered through Malden, and even more in Cambridge. The Boston Consolidated Gas Company serves a large suburban territory, including the town of Brookline.

Table IV shows the kw-hours generated and sold by each company, with the percentage of loss, the operating cost per kw-hour generated at the station, the pounds of fuel per kw-hour generated at the station, the cost of distribution per kw-hour sold and the total cost of manufacturing and distribution per kw-hour sold.

In the foregoing table the fuel consumption per kw-hour is based on the long ton and in the cases of the Lawrence and Springfield companies water-power plants are in service to supplement the steam stations. In Lynn, New Bedford and by the Boston Consolidated Gas Companies a number of fuels were used, prohibiting any comparison. The total cost per kw-hour sold includes the operating expenses at the station, the distribution expenses, the cost of management, taxes and incidentals. Interest, dividends and depreciation are not included in the above figures. These figures show the percentage dividends paid by the purely electric companies: Boston Edison Company, 11 (7.5 and 3.5); Worcester, 8; Lowell, 8; Fall River, 8; Malden, 9; Cambridge, 10; Springfield, 8; Brockton, 5.

Self-Starting Single-Phase Induction Motor.

The accompanying illustration shows a scheme for rendering a three-phase induction motor self-starting, as a split-phase machine receiving energy from a single-phase circuit, for which a patent was granted to Mr. A. R. Everest on May 12. The

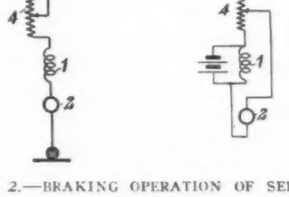


SELF-STARTING SINGLE-PHASE INDUCTION MOTOR.

automatic switch is arranged normally to establish running connections. The magnet of the switch is so proportioned that when the current exceeds a certain value, as during the starting period, the phase-splitting devices are in circuit and an accelerating torque is produced on the shaft.

Braking Operation of Series Motors.

A patent issued on May 26 to Mr. B. G. Lamme discloses a method for causing a series motor to operate as a braking generator under stable conditions. A storage battery is connected in shunt to the field magnet winding before the machine is connected to the braking circuit, so that it will begin operation as a separately excited generator and no severe shock will result. The storage battery remains connected in shunt to the winding during operation of the motor as a generator, and serves to cause a substantially constant amount of current to be



FIGS. 1 AND 2.—BRAKING OPERATION OF SERIES MOTORS.

supplied to the field magnet winding, so that stable conditions of operation are maintained. When only a small amount of current is generated by the machine, and only a small drop of potential occurs over the field magnet winding by reason of the armature current that traverses it, the storage battery will assist in supplying current to the field magnet winding and will

serve to maintain the field magnet strength at substantially its normal value. If the machine generates more than the normal amount of current, the drop of potential over the field magnet winding caused by this current will be increased above the voltage of the storage battery and the battery will be charged by the current generated in excess of the amount necessary to maintain the field magnet strength at substantially its normal value. Thus the field magnet strength is maintained substantially constant.

Society of Wireless Telegraph Engineers.

The annual meeting of the Society of Wireless Telegraph Engineers took place at 192 Bay State Road, Boston, Mass., on June 1, 1908. The secretary's report showed that the society held 10 meetings during the last year, at each of which a paper bearing upon the subject of wireless telegraphy was presented. Among the papers presented were the following: "On the 'Skin Effect' in Oscillation Circuits," by John Stone Stone; "On Tubular Condensers," by O. C. Roos; "On the Field for Wireless Telegraphy in the Philippine Archipelago," by C. E. Russell; "On An Experimental Verification of Oliver Heaviside's Theory of the Induction of Currents in Cores," by Dr. Roy T. Wells; "On Experimental Observations on the Audion," by Sewall Cabot; "On Experimental Observations on the Loss of Energy in the Dielectrics of Coils in Oscillation Circuits," by E. R. Cram.

It was decided at the annual meeting to make such changes in the constitution of the society as would enable it to increase considerably its membership. The following officers were elected for the ensuing year: President, Mr. John Stone Stone; vice-president, Mr. E. R. Cram; secretary, Mr. C. E. Russell; treasurer, Dr. Roy T. Wells. The following gentlemen are on the board of managers: Messrs. F. A. Kolster, A. P. Browne, C. C. Kolster.

CURRENT NEWS AND NOTES.

OPAL REFLECTORS FOR TUNGSTEN LAMPS.—Several manufacturers of opal glassware have recently taken up the manufacture of opal reflectors of proper size and shape to cover tungsten lamps and give good illuminating results.

OLD-TIME TELEGRAPHERS.—The Old-Time Telegraphers and the United States Military Telegraph Corps will hold their annual convention at the Cataract and International Hotel, Niagara Falls, N. Y., on Sept. 16, 17 and 18, when an attractive program of entertainment has been provided.

NEW YORK CENTRAL HEARING CONCLUDED.—At a brief hearing on June 15, by the Public Service Commission in New York City, the investigation into the aerial high-tension system in operation on the New York Central Railroad was concluded. The testimony was gone over and errors in the record corrected and the commission then set July 16, at 2 p. m., as the time for hearing arguments.

NEW YORK TELEPHONE AND TELEGRAPH REGULATION BILL IS NOT PASSED.—The Legislature at Albany adjourned June 11 after refusing to take up the bill recommended by Governor Hughes, extending the jurisdiction of the Public Service Commission to telephone and telegraph companies. The Senate bill embodying these recommendations was passed, but a similar bill introduced in the House was defeated by a vote of 55 to 36.

MOHAWK RIVER ELECTRIC POWER PROJECT.—Two companies were incorporated June 15 for the purpose of utilizing the undeveloped water power of the Mohawk River for the generation of electrical energy. The interests behind the Hudson River Electric Power Company are said to be the promoters of the two new corporations, one of which is the Mohawk Power Company, of Glens Falls, and the other the Public Securities Company, of Albany. The former apparently will be the operating concern, while the latter will look out for the financial side.

MACKAY SCHOOL OF MINES.—Telegrams from Reno, Nev., of June 10, state that by act of the Legislature the day had been celebrated as a State holiday on account of the dedication of the Mackay School of Mines and the Borglum statue of John W. Mackay, both presented by Clarence H. Mackay and his mother. As an additional evidence of the appreciation of the State, Governor Dickerson extended to Mr. Mackay and guests the freedom of the State, an unprecedented compliment. The decree of Doctor of Laws was conferred upon Col. George Harvey, who made the dedicatory address, and the degree of Master of Arts upon Katherine Mackay in recognition of her educational work. The services in front of the beautiful building, the last designed by Stanford White, were impressive.

TWO-CENT CABLE RATE PROPOSED.—John Henniker Heaton, a member of the British Parliament, who was a leader in the movement to secure a two-cent postage rate between England and America, announces that he will now devote his energies to securing a two-cent cable rate. Mr. Heaton suggested that the British and American governments should jointly acquire the property and rights of the existing cable companies at a fair valuation, establishing a common state of monopoly in cable communication. The Atlantic cables as they exist have a carrying capacity of 300,000,000 words per annum. At the present prohibitive rate of 1s., or 25 cents a word, only 25,000,000 are sent. If they were used to their full carrying capacity, Mr. Heaton has no doubt that the rate of 1d., or 2 cents, per word would be remunerative.

RURAL TELEPHONES FOR NEW ENGLAND.—The New England Telephone & Telegraph Company has proposed a new plan for rural telephone service whereby districts with a population of 20,000 or less can have telephone connections with the general New England system at a moderate cost. The idea is to reach the owners of detached farms, the country homes of business people from the cities, clubs, camps, stores, etc. The principal feature is the construction of private lines by the subscribers themselves, which will be connected with the nearest central office of the New England Telephone & Telegraph Company. The company charges 55 cents a month for residences and 70 cents a month for places of business to cover operating costs. The subscribers get not only unlimited communications with all the subscribers of the exchange, but access to the toll lines covering all New England and the eastern part of the United States.

CO-OPERATION DISCUSSED AT ELECTRIC CLUB, CHICAGO.—Mr. C. A. S. Howlett addressed the Electric Club, Chicago, at its noon meeting for lunch, June 10, on the far-reaching effects to be obtained by co-operation of all electrical men to secure the introduction of electrical appliances. He showed how every electrical appliance introduced meant more business for some one in the electrical field. Members of the club, he said, were all dependent upon the electrical business for a livelihood, and it was to their interest to have more co-operation in advancing electrical business in general. He also suggested that the club might well take a more active interest in civic problems involving electrical matters. Such civic problems had recently come up for discussion and were being handled by organizations whose members had but a small fraction of the knowledge of electrical affairs which the members of the Electric Club had. Among the civic matters which are up for discussion in Chicago at the present time in which members of the Electric Club are better posted than any other body of men, he referred to the electrification of steam railroads and the settlement of the controversy between the city and the sanitary district trustees as to the distribution of electric power from the drainage canal in the city of Chicago.

Turbo-Generator Station in Seattle, Wash.

AN 11,000-kw turbo-generator station has recently been placed in service in connection with the general energy-supply system of the Stone & Webster interests in Seattle, Wash., and vicinity. Energy is delivered from this system to operate the street railways, and for lighting and commercial purposes in Seattle. The chief source of supply for the system is a 15,000-kw hydro-electric station on the Puyallup River at Electron, 60 miles from Seattle. Owing to conditions favorable to the utilization of additional waterfalls in the vicinity, the bulk of the energy generated will also be obtained in the future from hydro-electric stations. The new steam station has therefore been designed as a relay to the present hydro-electric equipment and to such other installations as may be made. An existing 3500-kw steam-driven station in Seattle is also operated in connection with the general supply system.

The new turbo-generator station is on the right bank of the Duwamish River at Georgetown, four miles south of the business section of Seattle, and close to the transmission line from the Electron station, at a point where fresh water for condensing purposes could be obtained. The present station is the first one of six sections which are proposed to be built in conjunction on the same site. This section is entirely independent of the future additions, however, although the arrangement of its generator room is such that the latter will become a part of one main generator room as the other sections are built. The station building is a monolithic reinforced-concrete structure, 80 ft. x 218 ft. in plan, and with a height of 68.25 ft. from the ground line to the top of the roof.

The building is divided by a transverse 6-in. reinforced-concrete wall into a boiler room and a generator room, the former being 153 ft. 10 in. long, and the latter occupying the remainder of the building.

The original plans for this section of the station contemplated that two turbo-generator units, one of 3000 kw and one of 5000-kw rating, would be installed. Soon after the smaller unit had been erected, however, the decision was made to install a unit of 8000-kw rating instead of the proposed 5000-kw one, on account of increased demands on the system. Otherwise, the arrangement of the station was carried out as originally proposed. The two units are placed at the same floor level, with one unit on each side of the longitudinal center line of the building. Steam to operate each unit is normally supplied with steam by the row of boilers on the corresponding side of the boiler room, although both units can obtain steam from either side.

The boiler room contains 14 466-hp Stirling water-tube boilers, set in batteries of two with three batteries in a row on the 3000-kw turbine side, and four batteries in a row on the 8000-kw turbine side of the longitudinal firing-room floor. These boilers are at present fired with fuel oil. Since oil may eventually be superseded as fuel by coal, the storage bunkers for the latter were built over the firing floor and provisions were made in the construction of the building to permit coal-conveying apparatus to be installed.

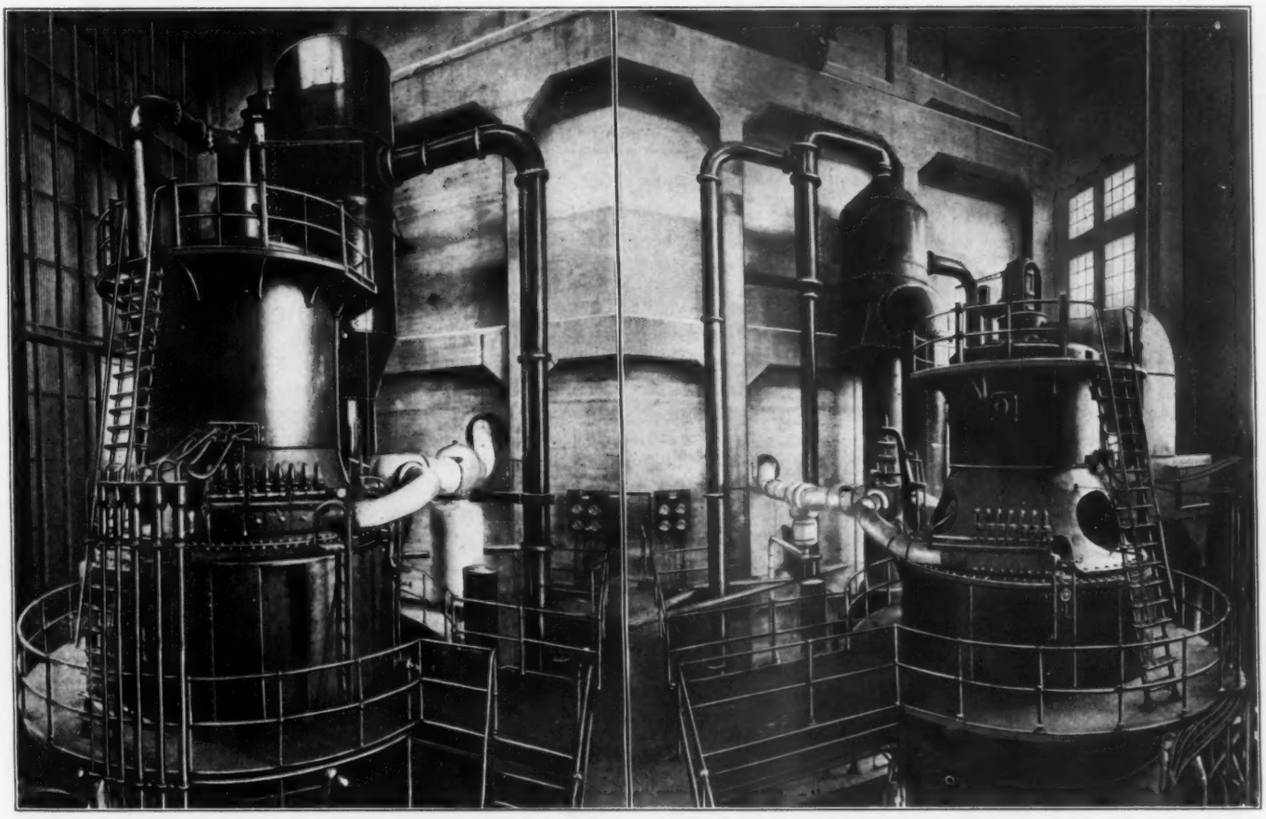


FIG. 1.—THE TWO MAIN UNITS IN THE GENERATOR ROOM.

A very complete storage and delivery system has been installed to handle the fuel-oil supply. The oil is delivered in tank cars on a switch extending around the downstream corner of the end of the boiler room next to the river. Three 8 ft. x 32 ft. circular steel tanks are placed side by side in the same horizontal plane under the track where oil can be delivered directly into them from the tank cars. A single-acting reciprocating oil pump, in a house at one side of this track, is also arranged to take oil from the tank cars through a 5-in. flexible suction hose and to deliver it through a 6-in. connection to a 150,000-gal. steel storage tank 30 ft. in diameter and 30 ft. high. This tank is placed with its center 83.5 ft. from the adjacent corner of the building and is surrounded by a pit large enough to hold the contents of the tank in case the latter should break. The exhaust pipe from the oil pump is connected to a steam coil

in the bottom of the oil tank in order to supply the heat necessary at times to thin the oil so that it will flow readily. A live-steam pipe is also connected to this coil as an auxiliary.

The section and discharge connections of the oil pump are joined with a by-pass pipe. This pipe and the suction and discharge connections are fitted with valves that enable the pump to be used in various ways. The oil can be taken from tank cars through the 5-in. flexible suction hose and delivered to the large storage tank through a 6-in. connecting pipe, or from that tank to the cars. Oil in the large tank will flow by gravity into the three underground tanks through the same 6-in. pipe to which the discharge pipe from the pump is connected, until the level in the large tank is reduced nearly to the bottom of the latter; after that the pump can be used to deliver the oil below that level. The pump can also deliver oil from the tank cars directly to the underground steel tanks.

Each of the three underground steel tanks is fitted with a live steam coil for heating the oil, these coils draining to the river. The 6-in. pipe into which both the discharge and the suction pipes of the pump are connected, and through which oil is supplied to or drawn from the large storage tank, passes around in front of the three small ones and thence into the station building. In the building this pipe is connected to a header from which two 10-in. x 6-in. x 10-in. Wagener steam-driven pumps receive oil. These pumps are arranged together in a pair, with two 2-ft. x 7-ft. circular oil-heaters between them. Each tank is supplied with exhaust steam for heating, and is operated similarly to a surface condenser, the steam taking the place of the cooling water. Each tank contains 87 ft. of 2-in. pipe, through which the oil is pumped under a pressure of about 40 lb. per square inch, which is maintained by an automatic pump governor. After passing the heater, the oil is delivered through filters to the burners under the boilers. Instead of an intermediate pressure-tank being placed in this supply system, the discharge pipe from each pump is fitted with a relief valve, the oil from which is carried back to one of the underground tanks by an overflow pipe.

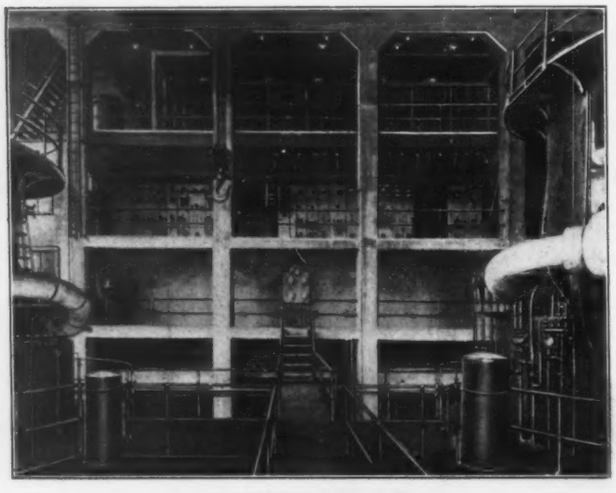


FIG. 2.—WIRING AND SWITCHBOARD GALLERIES.

A 2½-in. oil supply line is carried from the pumps along in front of both rows of boilers. This line is paralleled by a 2-in. pipe connected to the superheated steam main and also to a saturated steam main. At each boiler a connection is made to both supply pipes to deliver steam and oil to the burners under the boilers.

The boilers are of the standard Stirling water-tube type with the steam and water drums arranged parallel to the front surface and with a superheater in the rear pass.

GENERATOR ROOM.

One of the most significant features of the generator room is the fact that the generating equipment, with a normal rating of 11,000 kw and a guaranteed 50 per cent overload rating, or a total of 16,500 kw, is placed in a floor area 65.25 ft. x 73 ft. This area also includes the various auxiliary apparatus for the two units, including the condensers, exciters and the equipment of a substation installed in connection with the station.

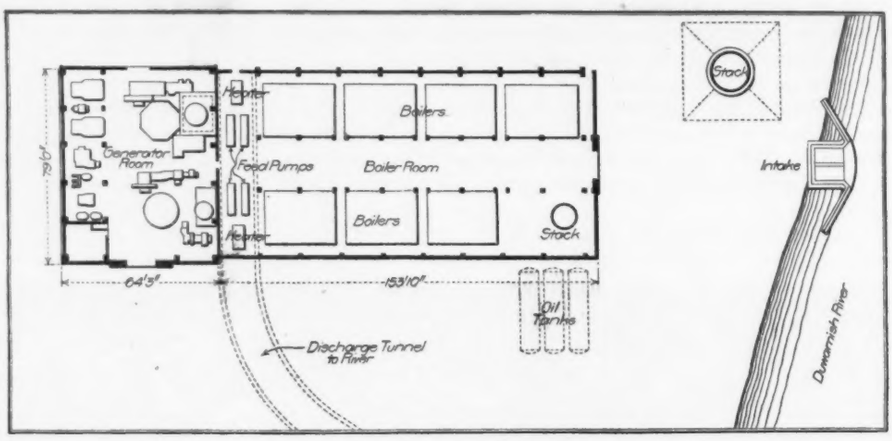


FIG. 3.—GENERAL PLAN OF STATION.

The two main units are General Electric Curtis turbo-alternators with three-phase, 60-cycle, 10-pole, separately-excited, revolving-field generators, designed to deliver energy at 13,800 volts and to operate at a normal speed of 720 r.p.m. The speed of the units is controlled by the standard turbine governor built by the General Electric Company, which is arranged so that it can be operated from the switchboard. The turbines operate on a normal steam pressure of 175 lb., with 110 deg. of supertemperature.

The turbine of each unit is served by a Weiss counter-current barometric condenser. The cooling water for the 3000-kw unit is delivered into the condenser by a 12-in. horizontal centrifugal pump, directly connected to a 10-in. x 12-in. high-speed Porter-Allen engine. This pump draws water through a 16-in. pipe extending from the intake at the river, where the 10-in. boiler-feed supply pipe starts in the underground trench to the pump. The water passing through the main barometric tube is discharged against the pressure of the atmosphere into a hot well. A secondary barometric tube with a foot-valve is provided to remove any moisture that might otherwise be carried into the dry-air pump. The latter is of the horizontal tandem Weiss crank and fly-wheel type, with a 34-in. air cylinder and a 12-in. steam cylinder. The speed of this pump is controlled by a throttling governor arranged for variable speeds.

The condenser of the 8000-kw unit is supplied with 1500 gal. of cooling water per minute by an 18-in. horizontal centrifugal pump driven by a 11-in. x 14-in. Porter-Allen high-speed engine. It has a Weiss dry-air pump with a 48-in. air cylinder, an 18-in. steam cylinder and a 30-in. stroke. The water from this condenser is also discharged into a hot well. The sizes of the condenser for the large unit are quite unusual, as may be seen from the following: The exhaust connection of the turbine to the condenser chamber is 78-in. in diameter and rises to a height of 41 ft. above the floor of the generator room; the main shell of the condenser, with a diameter of 9 ft., has its top 54.5 ft. above the generator room floor and the condenser receives 30,000 lb. of steam per hour when the unit is operating at the normal full load. The condenser equipment was furnished by the Southwark Foundry & Machine Company.

The overflow water from the hot wells, to which it is discharged from the condensers, passes into a tunnel, 8 ft. x 12.5 ft. in cross-section, which extends transversely under the end of the basement of the boiler room, close to the partition wall between that room and the generator room. This tunnel is

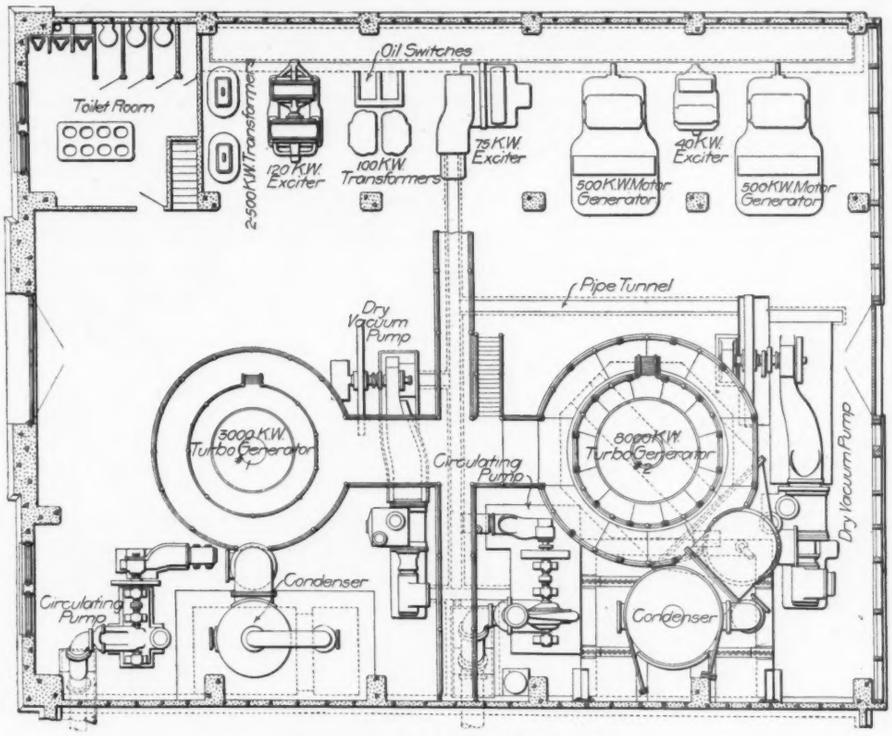


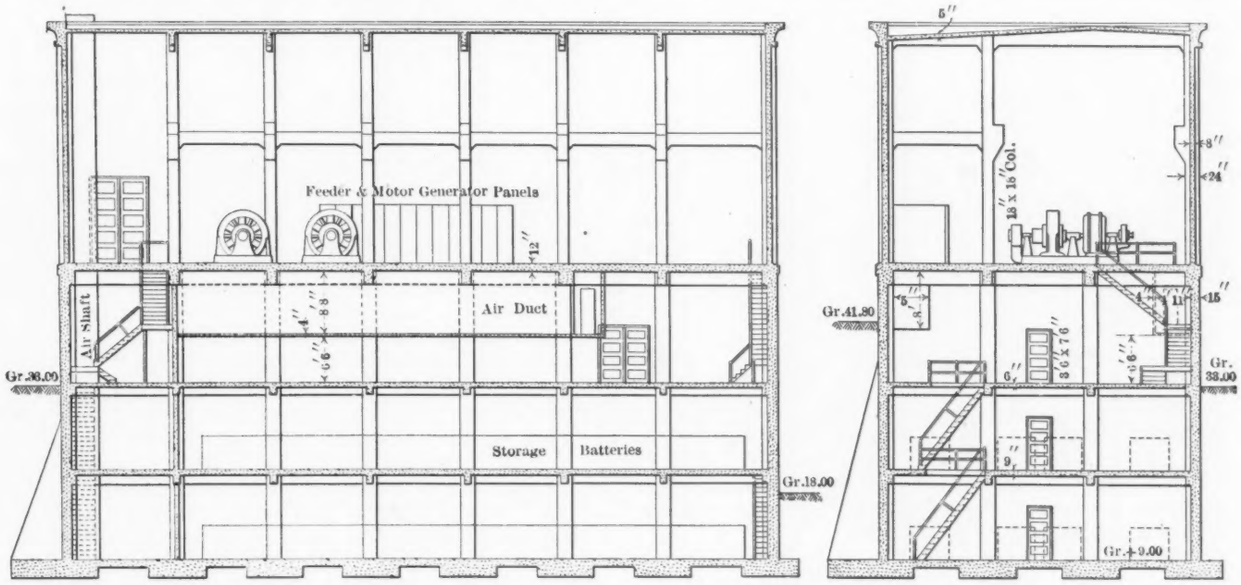
FIG. 4.—PLAN OF GENERATOR ROOM.

lined with concrete and extends for about 300 ft. across the land adjacent to the building to an outlet in the river, more than 200 ft. down-stream from the intakes of the pipes through which cooling water is supplied to the condensers. The cross-section of the tunnel is of sufficient size to permit the tunnel to be extended into the additional section of the ultimate station as these sections are built.

The step-bearings of the two main units are supplied with oil from a common high-pressure system. Two 7½-in. x 2⅛-in. x 18-in. duplex high-pressure Worthington pumps are installed in the basement of the boiler room to furnish pressure to this system. These pumps are in duplicate, and either of them is sufficient for the service required. The pumps deliver oil at a pressure of about 1300 lb. per square inch into duplicate mains leading to the two units. A 3-in. x 5-ft. hydraulic accumulator is placed in this delivery system to maintain a uniform pressure in the latter. The step-bearing of the 8000-kw unit is lubricated with oil at a pressure of 1000 lb. per square inch, and the step-bearing of the 3000-kw unit at a pressure of 460 lb. The pressure in the mains is reduced to that required in each case by a baffler in the supply pipes, close to the bearings. The overflow oil from the step bearings is returned to either or both of two Turner receiving and filtering tanks. One of the latter holds 450 gal. and can filter at the rate of 20 gal. per minute; the other holds 400 gal. and can filter at the rate of 12 gal. per minute. The two high-pressure pumps have a suction connection with the storage tank of both of the filters.

The intermediate bearings on the two main units are supplied with oil under a pressure of 120 lb. by two 9 and 3.5 x 10-in. cross-compound Worthington pumps, installed in duplicate. These two pumps also take suction from the storage tanks of the two filters. A 3-ft. x 6-ft. air tank is placed at each unit on the delivery pipe from these pumps to maintain a uniform pressure at the units. An emergency connection is also made between the delivery pipe of these pumps and the high-pressure oil main, in order that the one of the two pumps of the intermediate system which is not supplying oil to the steady bearings may deliver to those mains in an emergency.

The equipment of the entire station is supplied with lubricating oil from a complete separate system. This system is served by two oil pumps, in duplicate, with a 400-gal. oil tank in the monitor of the boiler room connected directly to the delivery system. A connection is made from the latter to the



FIGS. 5 AND 6.—LONGITUDINAL AND CROSS-SECTIONAL ELEVATIONS OF UNION STREET SUBSTATION.

high-point of each unit, and branches are extended from this connection. The waste oil from the units is carried by gravity back to a sump tank under the floor of the boiler-room basement. The oil is blown from this tank under air pressure, which is supplied by compressors in the basement, to a separate Turner oil filter from which the station oil pumps take oil by suction.

Two compressors are installed in the basement of the boiler room to supply air under pressure for various purposes about the station. These compressors deliver to a tank from which connections are made to all parts of the station.

Two direct-current generators, one a 40-kw motor-driven unit and the other a 75-kw engine-driven set, were installed to furnish excitation current for the 3000-kw main unit. A 120-kw motor-driven exciter was added when the 8000-kw main unit was installed. All of these exciters are placed on the first gallery floor, which is at the same level as the operating floor around the main units. On this floor are also mounted two 500-kw motor-generator sets for supplying direct-current at 600 volts locally to the street railway system. Two 100-kw transformers are placed on this floor to supply current at 2300 volts for lighting and to drive small motors in the station. A local brewery is also supplied with 2300-volt current directly from the station, two 500-kw water-cooled transformers on the first floor of the gallery being used for this service.

The second gallery floor is a separate room for wiring connections, except for an office at one end. The third floor contains the switchboards from which the operation of the various equipment in the generator room is controlled. Motor-operated oil switches on the high-pressure connections of the station are placed on the fourth gallery floor. The top floor is given over to lightning arresters, static dischargers and outgoing transmission-line connections.

The main units are arranged for remote control from a switchboard on the third floor of the operating galleries. A cable from each phase of both main generators is carried from the latter in brass pipes leading to conduits under the floor of the generator room. These conduits extend to the end wall of the building at the rear of the galleries and the cables are carried up a 12-in. space between this wall and the gallery floors to motor-driven oil switches on the fourth floor of the gallery. The second floor of the latter is utilized exclusively for wiring connections. This floor is separated from the generator room by a light concrete partition, with access to this wiring room from only the end of the gallery by means of concrete stairways. The remainder of the gallery floors, which are entirely of reinforced concrete, are reached by stairways of concrete, so that the gallery structure is fully fireproof.

The operation of the main generators and their exciters is controlled from a 10-panel switchboard on the third floor of the gallery. The panels of this switchboard are of blue Vermont marble equipped with standard G. E. switches and recording and indicating instruments. The operation of the equipment of the substation is controlled by a separate eight-panel switchboard on the same floor. A third two-panel switchboard is installed on this floor to control the operation of connection to the transformers installed on the first floor of the gallery to supply energy to a local brewery.

The 13,800-volt energy delivered by the main generators is carried out of the station at that voltage to either of two substations near the business section of the city, descriptions of which are given below. The e.m.f. is decreased to 2300 volts in these substations for local distribution. Transformers in the generating station are therefore not necessary.

UNION STREET SUBSTATION.

This substation, four-sevenths of which has been completed, is located on the south side of Union Street between First and Western Avenues, on the steep hill running from the water front. It was designed as a combined three-wire direct-current lighting and transformer station. The ultimate equipment will consist of 5000 kw in motor-generators made up for four 1000-kw, three-phase, 13,200-volt, 50 cycle, 125- and 250-volt direct-current lighting motor-generators and two 500-kw, two-phase, 2200-volt, 60-cycle, 720 r.p.m., 125- and 250-volt, direct-current, interpole lighting motor-generators, these latter machines representing the present equipment. In addition to the generator equipment, three 2000-kw banks of 13,200-volt, three-phase to 2200-volt, two-phase transformers are to be installed together with two lighting storage batteries, each of 5440 amp-hour rating. Ultimately there will be four lines entering the station, two two-phase 2200-volt and two three-phase 13,200-volt. As the two two-phase and two three-phase lines are brought to the station from different parts of the company's system, it will readily be seen that a number of relay combinations are possible.

The switchboard is located on the main floor of the substation. The present board consists of two 2200-volt motor panels,

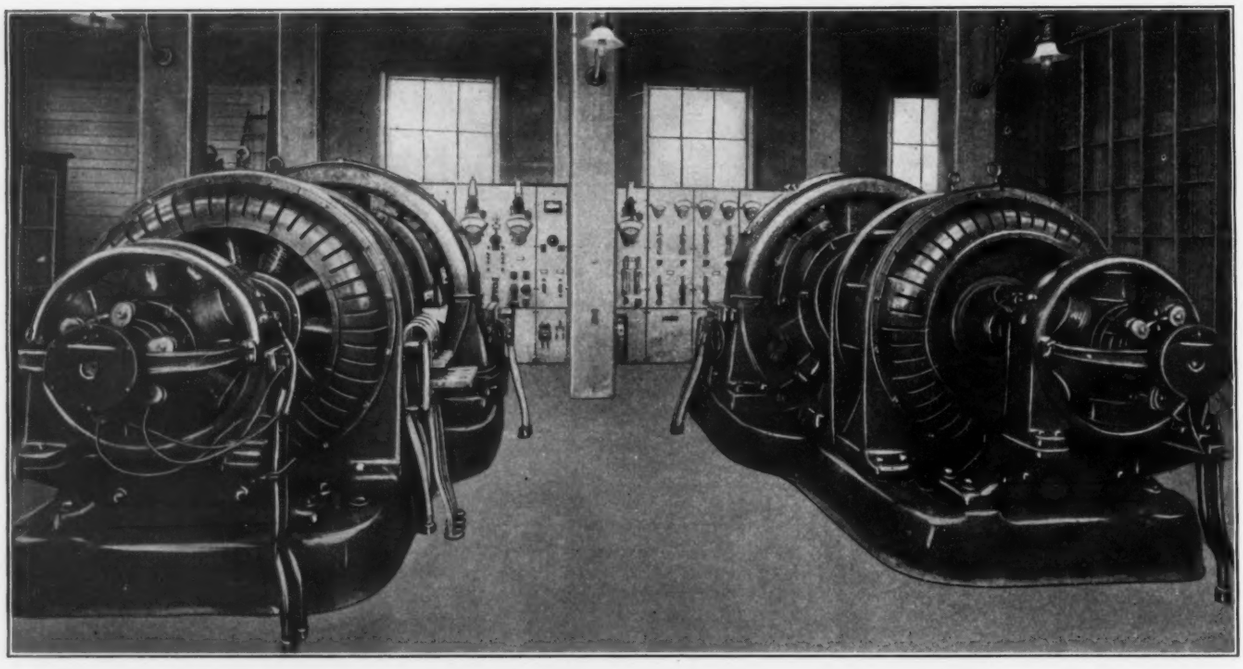


FIG. 7.—MOTOR-GENERATOR SETS AND SWITCHBOARD IN UNION STREET SUBSTATION.

two 250-volt three-wire generator panels, six 1500-amp three-wire feeder panels and a pressure panel, the latter containing direct-current voltmeters for obtaining the voltage of the generator, buses and feeder distribution centers. A swinging bracket contains an alternating-current voltmeter and synchronoscope. Each motor panel has remote-controlled oil switches operated by 125-volt direct-current solenoids. Two control-switches are used on each panel, one for the starting compensator oil switches and the other for the main switch between the motor and the bus. The main and compensator oil switches for each motor are electrically interlocked so that it is impossible to close either switch until the other has been opened.

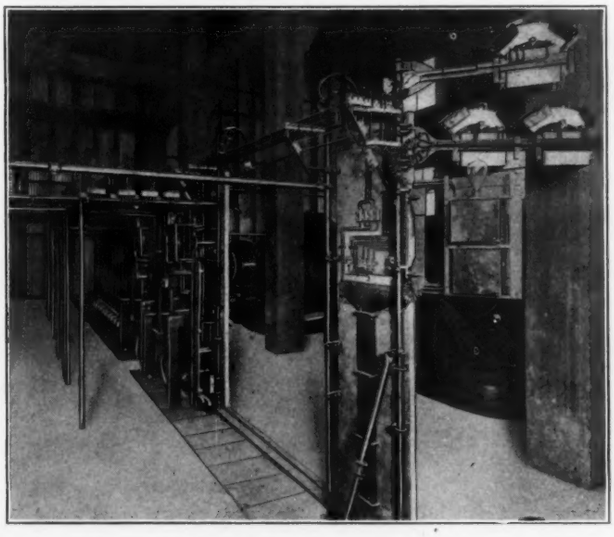


FIG. 8.—REAR OF SWITCHBOARD IN UNION STREET SUBSTATION.

Each motor panel contains an overload time-limit relay. Each direct-current generator panel contains two ammeters, two single pole automatic circuit breakers with speed-limit trip, two single-throw, 3000-amp switches for high bus, two double-throw, single-pole, 3000-amp switches for low bus and a future battery charging bus, a direct-current starting switch, two double-throw, single-pole field circuit transfer switches, one double-pole field circuit switch, field rheostat mechanism and a three-wire watt-hour meter. Each feeder panel contains four single-pole 1500-amp switches for high and low bus, and two ammeters.

Subsequently there will be added nine direct-current feeder panels, two battery panels, one booster panel, four 1000-kw generator panels, four motor panels, three transformer panels and four incoming and outgoing line panels; the total length of switchboard will be about 80 ft.

Below the generator room is the switch and high-tension bus room. At present there are installed six 2200-volt oil switches, each consisting of four single-pole switches mounted in concrete cells and electrically operated from the switchboard. The compensators for obtaining the neutral for the three-wire system are also on this floor, the disconnecting switches for use with these compensators being mounted on the side of the machines and the neutrals connected together. The future arrangement in this room calls for five additional two-phase switches, three for transformers and two for lines. The bus as extended will be double, and bus selector-switches are provided for at the end of the present generator bus.

The 13,200-volt three-phase arrangement will consist of a double 13,200-volt bus and a 6900-volt starting compensator bus. With the latter bus, two compensators will be used for the four 1000-kw motor-generators, each relaying the other, it being possible to start any machine from the starting bus. The operating switches will be interlocked in a manner similar to those of the 2200-volt machines described above. All of the oil switches will be of the cell type, each pole being in a separate concrete compartment. There will be three transformer switches, two line switches and 12 motor-generator and starting-compensator switches.

The direct-current cables and bare copper bars leaving the switchboard above also pass through this room, the cables leading to the street and the copper bars to the battery and end cell rooms below. It has been arranged to use bare copper bars for leads from the direct-current side of the four 1000-kw generators to station buses and in order to keep these latter bars as near as practicable to the ceiling of the switch room; the beams being very deep, suitable holes were left in the concrete beams for inserting soapstone insulation. All of the wire and cable used larger than No. 6 will be insulated with varnished cambric and covered with a white flameproof braid. All auxiliary wiring is installed in iron conduit buried in the concrete, and conduit has been installed for future apparatus. The bends were made of especially large radius in order to facilitate pulling in the cables. A considerable amount of labor was saved by inserting all bolts for support of bus framework, copper and cable in the forms before concreting.

NORTH SEATTLE SUBSTATION.

This station is located to the rear of the new North Seattle concrete car barns of the Seattle Electric Company, on the north side of Republican Street between Sixth and Taylor Avenues. At the southwest corner a wire-tower was erected as a part of the building for 13,200-volt incoming lines, outgoing 2200-volt lines and a number of 600-volt feeders. The tower begins in the basement of the building and projects above the roof. Entrance may be had to it either from the switch room floor or from the generator room, where a concrete platform was constructed from which the line disconnecting switches are operated. The lower, or switch-room, floor contains all of the 13,200-volt line and generator oil-switches, starting auto-transformers and switches for the latter with provisions for all future 2200-volt lighting and industrial switches and potential regulators.

The generator room, at present, contains one 1000-kw, 514 r.p.m., 13,200-volt, 60-cycle railway motor-generator set delivering direct-current at 600 volts to the trolley system. The switchboard on the north side controls all of the oil switches in the basement, as well as the 600-volt feeder system.

The station was designed as a combined direct-current railway and alternating-current lighting and power substation. The

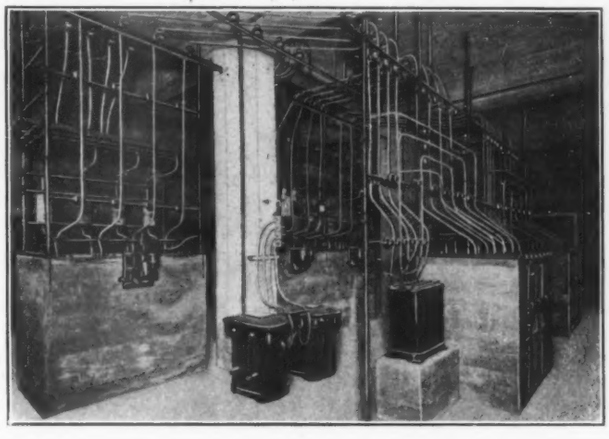


FIG. 9.—WIRING CONNECTIONS IN SWITCH ROOM OF UNION STREET SUBSTATION.

final equipment will consist of three 1000-kw, 13,200-volt, 60-cycle, three-phase motor-generators, three 2000-kw banks of 13,200-volt, three-phase to 2200-volt, two-phase transformers similar to those in the company's Union Street substation, and two motor-driven blower sets.

The switchboard is located near the north wall on the same floor with the generators and transformers. The present installation consists of one direct-current railway generator panel containing one single-pole automatic overload circuit breaker

with speed-limit trip, ammeters, negative main switch, starting switch, single-pole field switch, watt-hour meter, rheostat mechanism and the usual plugs and receptacles, one alternating-current motor panel containing an ammeter, motor-field switch, rheostat mechanism time-limit overload relay, and two auxiliary switches electrically interlocked for operating the oil switches, one for the starting compensator and the other for the main bus, and six standard 1200-amp railway panels, each containing one single-pole, single-throw switch and circuit breaker and an ammeter.

Subsequently there will be added two 1000-kw direct-current generator panels, two motor panels, two 13,200-volt line, three transformer, one 2300-volt two-phase industrial and six 2300-volt single-phase lighting panels.

Below the generator room is the switch and bus room. At present there are installed three three-phase, 13,200-volt oil switches in concrete cells, operated from the switchboard above. The main bus is double with selector disconnecting-switches. An auto-transformer starting bus is used. The ultimate number of three-phase oil switches will be 12, and on the north side of the room provision has been made for one two-phase industrial, three transformer and six single-phase, 2200-volt lighting switches and induction voltage regulators. All oil switches will be of the remote-controlled cell type.

A channel iron cable rack passes along the north and west walls of the switch room to the wire-tower in the southwest corner of the building. At present only one 13,200-volt incoming line is installed. It enters the building from the west side of the tower down which it runs to the switch room. Choke coils are mounted on the inside wall of the tower, but the lightning arresters are placed on the generator room side of the wall in plain sight of the operator.

All cable and wire used are insulated with varnish cambric as at the Union Street substation, and covered with a white flame-proof braid. The 13,200-volt buses are of No. 40 solid copper mounted on line insulators. The distribution of all small leads, exciter and field wiring, from the switchboard is by means of iron conduit buried in the concrete; all hanger and cell supporting bolts were fastened to the forms before the concreting was done.

The above described station and substation were designed by the Boston office of the Stone & Webster Engineering Corporation. The construction of the buildings and the erection of the mechanical equipment were carried on under the direction of the Seattle office of that corporation, of which Mr. M. J. Whitson is superintendent. Mr. H. H. Barter was engineer in charge of the installation of the equipment. The electrical equipment was furnished by the General Electric Company.

Meter Laboratory of the Birmingham Railway, Light & Power Company.

The meter laboratory of the Birmingham (Ala.) Railway, Light & Power Company is one of the most complete for its size in the South. It is located on the third floor of the company's office building at the corner of First Avenue and Twenty-first Street, and occupies a main testing section 31 ft. long by 20 ft. Being located on the southwest side of the building, with four windows opening on the street, the laboratory is at all times amply supplied with natural light for the accurate work demanded. Fig. 1 shows a general view of the laboratory.

About 7400 electric meters are in service on the company's circuits and the principal work of the laboratory is the maintenance of these with tests of various kinds on meters or lamps, adjustments for better accuracy and any special investigations that may be needed from time to time by any department of the company. Five men are constantly at work inside or outside the laboratory making meter or other tests. The laboratory supplies the standards by which all portable checking instruments are tested, and the secondary standards used in meter testing are frequently compared with the company's most accurate instruments.

Two permanently-wired switchboards are installed in the laboratory. These are arranged so that meters can be connected to the testing circuit with minimum loss of time. Both boards are shown in the accompanying illustrations and are designated as "A" and "B" for convenience. Board "A" (Fig. 2) is mainly used for testing larger meters, from 50 to 600 amp rating, single-phase, polyphase and direct current. The smaller meters are tested, as a rule, on board "B" (Fig. 3). The wiring of each board, however, is flexible enough to permit a number of other tests to be made without disturbing the connections. Both switchboards have white marble panels, and are provided with instruments, plugs and controlling switches, mentioned later.

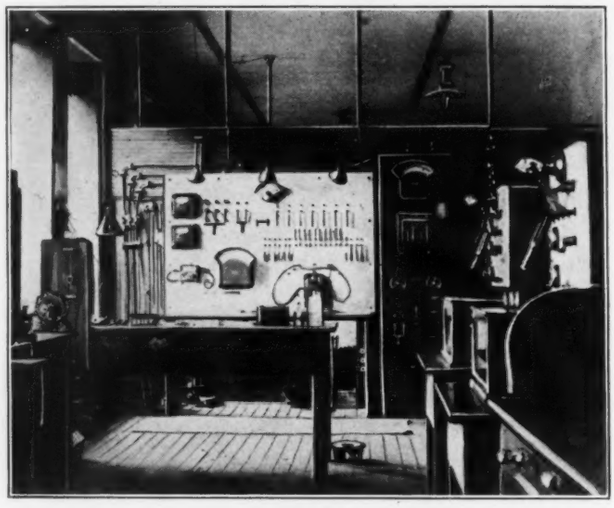


FIG. 1.—GENERAL VIEW OF LABORATORY.

In front of one of the windows is installed a speed lathe driven by a ½-hp, 230-volt motor, whose speed is 1400 r.p.m. The motor is set upon the window sill and a short countershaft is mounted in the upper part of the window for the driving adjustment. The starting box is located beneath the window casing conveniently for the lathe user. This lathe is used in polishing pivots, winding resistance tubes and coils, straightening shafts and other light work. A table for general instrument repairs is provided, and there are two vertical panels adjacent to it for the checking of test instruments. The table and panels are shown at the right in the general view of the laboratory. Mounted near the panels and connected with them are two standard indicating wattmeters, one scaled 0 to 1500 and one 0 to 3500 watts. The equipment also included a testing transformer of 115 volts primary and 10,000 volts secondary potential. This transformer is for use in making insulation tests, also in testing line transformers. A small motor with grinding and buffing attachments is mounted on one of the

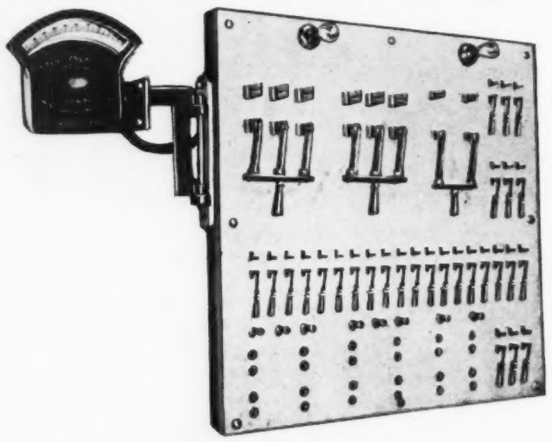


FIG. 2.—BOARD A.

work benches and has proved one of the most convenient tools in the laboratory. To enable a steady current to be available when needed for testing, there is installed on another part of the floor a 4.5-kw motor-generator set which consists of a 220-volt motor direct-connected to a 110-volt generator, the set having a normal speed of 1800 r.p.m. The current from this

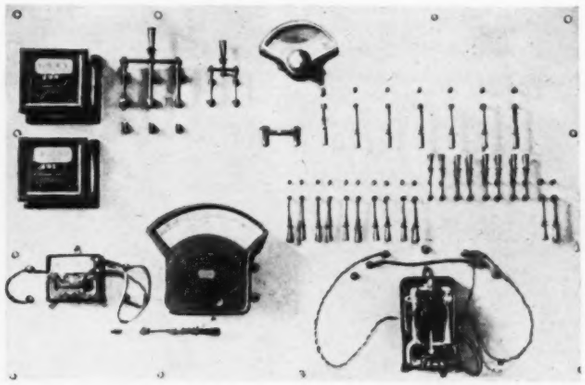


FIG. 3.—BOARD "B."

set is brought to the laboratory and is controlled by a Tirrill regulator on a special panel, shown at the right of switchboard "B" in the general view of the laboratory. This current is used for excitation purpose at both switchboards and is kept quite constant by the regulator.

The general wiring arrangement of the board "A" is shown in Fig. 4. This panel is about 4 ft. square, and contains at the top service switches supplying 110-, 220- and 550-volt direct current and 110- and 220-volt alternating current. The terminals of these switches are connected on the back of the board to busbars. By means of plugs and flexible cables instruments can be connected in various ways between the busbars and supplied with the requisite current for testing. At the left of the panel, on a bracket, is mounted a 1000-amp meter of the station type, with 10-, 100- and 1000-amp shunts. According to the load upon the tested instrument the proper ammeter shunt can be connected in at once without the trouble of making wiring changes. The load for the instruments is provided by a bank of fuse resistance coils mounted in a truncated box in front of one of the laboratory windows, the scheme of connections being shown in the drawing. This resistance is cut in or out by 30 single-pole knife switches connected to the coils on one side and to the positive busbar on the other. One side of the resistance coil is connected to the negative bus. The coils are attached to insulators so as to run up and down, vertically, and the heat given off is drawn out of the room and discharged out of doors by a 16-in. exhaust fan located at the mouth of the funnel, which is formed by the truncated box. In this way the apparatus can be operated on the warmest days without discomfort to the laboratory staff, and the danger of fire from overheated coils is reduced to a minimum. The fan is controlled from the switchboard and the box is lined with asbestos. The resistance gives a range of current adjustment of from ½ to 80 amp per switch, and is capable of consuming about 600 amp with all coils in use.

Bord "B" contains a 25-amp General Electric watt-hour meter which is checked against the company's primary standards every few days, and also a 5-amp watt-hour meter. This board is supplied with 110- and 220-volt currents, and the load is secured by resistance coils mounted on the wall behind the panel. An ammeter and voltmeter are also provided for use on direct-current tests. The resistance wires are of German silver and are mounted on insulators supported on an asbestos backing. To provide for the expansion of the wires, each wire is supported at its middle point by a pin block and small spiral spring which enables the slack to be automatically taken up and permits the necessary increase in length as the wire heats up. The wiring in the laboratory is for the most part run behind the baseboard of the wall with a false molding that can be swung up out of place whenever any repairs or circuit changes are needed.

The method of meter testing employed is largely by the use of rotating standards. It is thought best to use this method in preference to the indicating instrument method, because it simplifies the work, enables more meters to be tested and reduces the chance of error.

The rotating standards are, of course, frequently checked against the primary standards, which are indicating instruments of laboratory type. Besides the rotating standards there are very many voltmeters, ammeters, millivoltmeters and wattmeters for use in the various tests. The laboratory of the Birmingham Railway, Light & Power Company is in charge of Mr. F. M. Underwood.

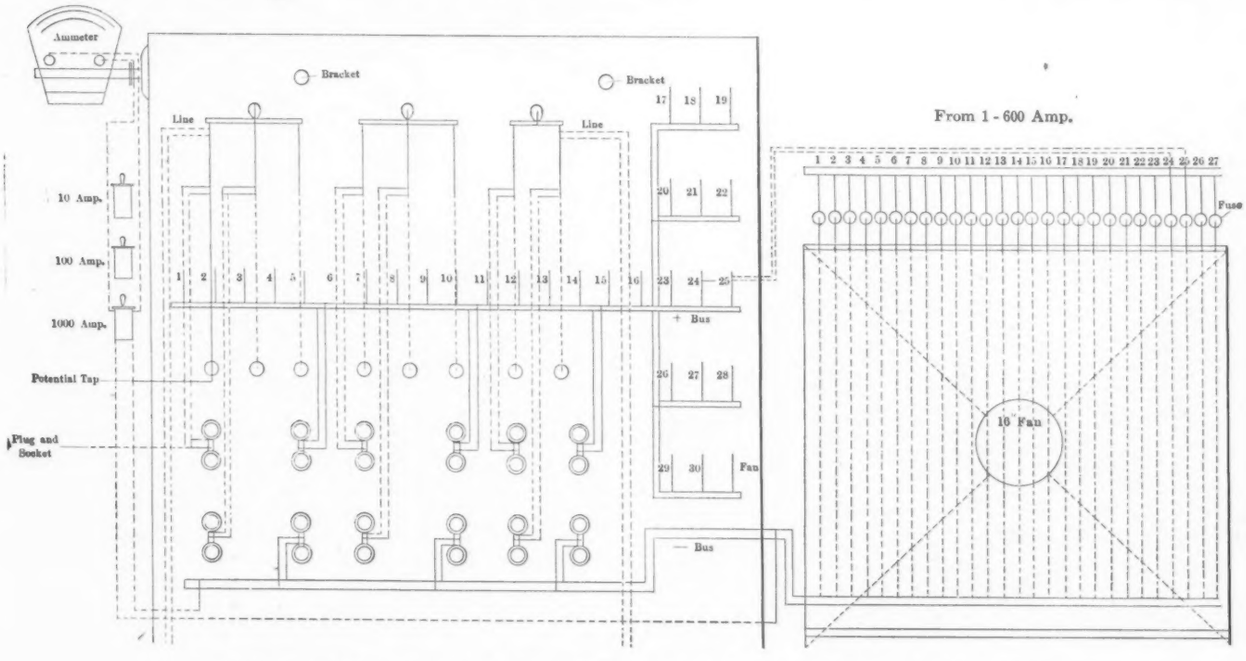


FIG. 4.—CONNECTION DIAGRAM BOARD "A," BIRMINGHAM CENTRAL STATION LABORATORY.

Electrical Engineering Equipment at Clemson College, South Carolina.

Engineering courses are now available in a large number of Southern colleges and universities, and in some of these institutions the equipment and instruction offered to the undergraduate student are thoroughly representative of the best accepted methods of technical education. In the field of electrical and mechanical engineering one of the most highly developed courses in the South is that of Clemson College, South Carolina, and this institution so well typifies the best progress in undergraduate instruction in applied electricity that its facilities have been thought worthy of description.

Clemson College is one of the youngest institutions in the South, having been opened in July, 1893. It is located on the old Fort Hill homestead of that well-known statesman, John C. Calhoun, about one mile from the Calhoun station of the Southern Railway, and at an elevation of 800 ft. in the picturesque foothills of the Blue Ridge Mountains. The homestead and study of Mr. Calhoun are preserved on the campus. The first step toward the establishment of the college was made by the Hon. Thos. G. Clemson, son-in-law of Mr. Calhoun, who in 1888 bequeathed to the State the Calhoun homestead, with other securities for the establishment of an agricultural college. Instruction in the sciences rather than the classics has been the object of the institution, which is one of the few purely technical colleges in the South. Courses are offered in agriculture, chemistry, animal industry, geology, civil engineering, textile industry, mechanical and electrical engineering. The students are under military discipline, the Commandant of Cadets being an officer of the U. S. Army. Each course leads to the degree of B. S.

The mechanical and electrical courses are combined at Clemson in a single curriculum, and aim to lay a solid scientific foundation by both theoretical and practical instruction upon which the student may build rapidly after graduation. Thorough work is given in English, and as far as time permits, civics, economics, geology and botany are taught in the course as well as the partly technical sciences of mathematics, physics and chemistry. Within the department are taught physics, mechanics and mechanical engineering. Along with the theoretical instruction, practice is given in the laboratories and in the extensive shops which form an important part of the equipment. A strong course in drawing is one of the prominent features.

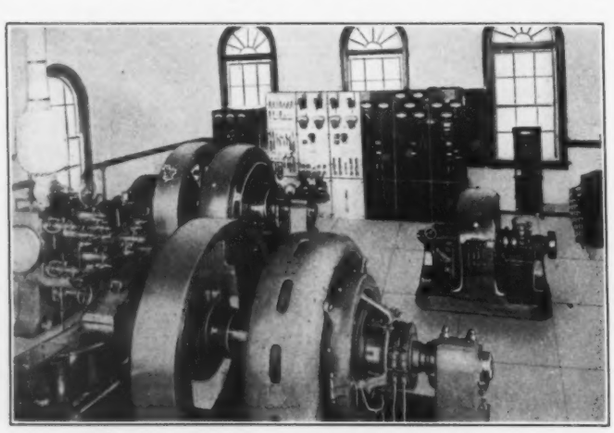


FIG. 1.—VIEW OF GENERATING STATION.

All the college buildings are supplied with heat, and electricity from a new central power plant conveniently located on the campus. This plant was designed with the idea of utilizing it for instruction as well as for the service of the buildings. The power house is a single-story structure 84.5 ft. long by 40 ft. wide, built of 8-in. cement granite-faced blocks, backed up with 4 in. of red brick. The roof is of truss construction with Cortright metal shingles and Dixie ventilators. The plant has a 46 ft. x 38 ft. boiler room, a 27 ft. x 38 ft. engine room, and three smaller rooms, one for oil, one for pumps, heaters, e.c., and the other for toilet and bath. A tiled floor is provided in the engine room, and the cost of the building was about $4,500.

The boiler equipment consists of one battery of two 150-hp Stirling units and two 100-hp Lombard return tubular units. The Stirling battery cost about $4,000. The horizontal tubular boilers are the only apparatus from the old plant used in the new station. The products of combustion are delivered into the stack by a 3 ft. x 7 ft. breeching. The new boilers are normally operated at 130 lb. pressure, but the old units, used only in steam heating, carry 80 lb. The stack was built by the Alphons-Custodis Company at a cost of about $2,200. It is 100 ft. high above the foundation and 60 in. inside diameter, being large enough for 700 boiler horse-power, if that output is later needed.

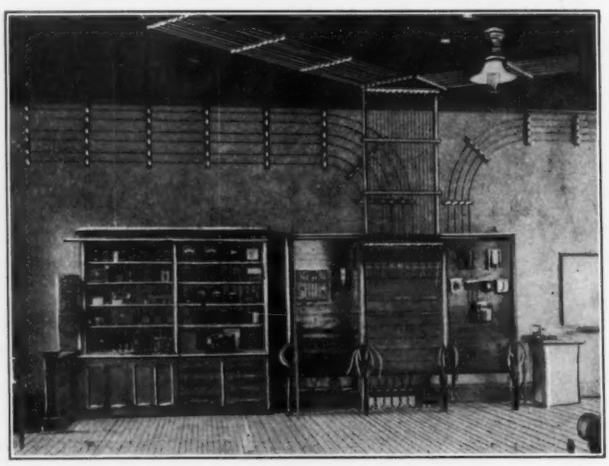


FIG. 2.—PLUG SWITCHBOARD, SENIOR ELECTRICAL LABORATORY.

The steam heating of the mechanical, chemical and electrical buildings, and the old and new barracks, is effected by the Webster vacuum return system. The mechanical and textile buildings are also provided with steam at 130 lb. for engines and heaters. The installation was planned to heat the barracks by the exhaust steam from the engines in the plant.

The engine room equipment consists of two units. One is a 13½ in. x 12 in. four-valve Harrisburg engine, directly connected to a 75-kw General Electric three-wire direct-current generator. This unit operates at 225 r.p.m., 125 and 250 volts, and has 5 per cent overcompounding. This four-valve engine is probably the most efficient simple high-speed engine built, its steam consumption being 24.5 lb. per hp-hour at half load and 25 per cent overload, and 23 lb. and 23.5 lb. at three-quarters and full load, respectively. The generator has a full-load efficiency of 91 per cent, and a half-load efficiency of 89.5 per cent. The other generating unit is a 13 in. x 13 in. piston slide-valve engine of the Harrisburg make, directly connected to a 70-kw, three-phase, 2300-volt revolving-field alternator. The engine shaft carries a 6-kw exciter for this set. The range of steam consumption of this engine is from 29 lb. per hp-hour at half load to 27.2 lb. at full output. The current is of 60 cycles frequency. The efficiency of the alternator varies from 83 per cent at half load to 89 per cent at full load, and it has a voltage regulation of 8 per cent. In addition to the generators, the engine room contains a 75-kw rotary converter that can be operated from either end. It is connected to the alternator through three 25-kw, 2300 to 185-volt, single-phase, oil-cooled transformers, with half-voltage taps for starting. On the alternating-current side are reactances for 5 per cent over-compounding on the direct-current side. The rotary has a compound field winding, and gives 250 volts at the brushes, the neutral on the three-wire system being joined to the central point of the transformers on the alternating-current side. The speed of the rotary is 1200 r.p.m. A compound field winding

is used when running from the alternating-current end, but when running inverted, the series turns are short-circuited.

The switchboard equipment consists of six panels, three alternating-current and three direct-current. The alternating-current panels are of black enameled slate, and consist of the rotary panel, the three-phase generator panel, and a three-phase feeder panel. The direct-current panels are of blue Vermont marble, and are assigned to the three-wire generator, to the direct-current side of the rotary, and to direct-current feeders. The rotary panel contains the starting de-

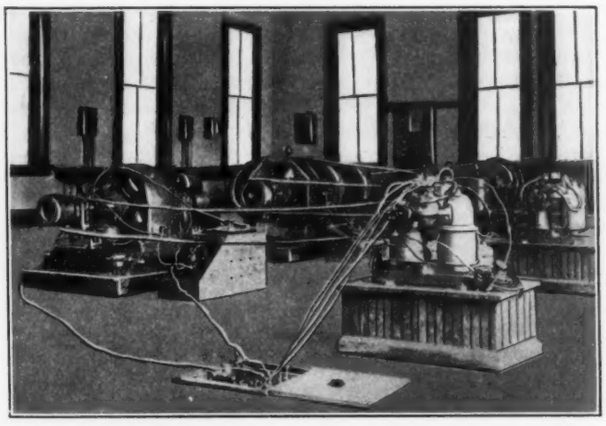


FIG. 3.—VIEW OF FLOOR BOX AND BOX FOR MAKING CONNECTIONS WITH SWITCHBOARD.

vices used in running the rotary inverted. There is also one starting panel for operating the rotary from the alternating-current side.

With this equipment, the station can furnish its entire output either in alternating or direct current, or half of each kind. Either unit can be substituted for the other, and if necessary in the future, the direct-current generator and the rotary can be put in series to give 500 volts for operating an electric railway line to Calhoun. Usually, during the heating season, when economy in steam consumption is not an important item, to run the alternating-current unit alone is run, direct current being obtained from the rotary for the Edison three-wire system of lamps and motors, and alternating current is supplied directly for operating a water pumping station and for the laboratory. By the installation of a synchronous motor in the electrical laboratory building, a prime mover can be had whose speed regulation depends only upon the speed of the engine which drives the alternator. If it is desired to have alternating current without operating the engine, the rotary can be run inverted to supply energy for the pumping station. The cost of the electrical equipment was about $7,000, and the cost of the engines, with foundations, was about $3,000.

The principal buildings concerned with the electrical and mechanical course are the dynamo laboratory, the electrical instrument laboratory and the mechanical laboratory. The dynamo laboratory is a modern brick structure, 80 ft. by 37 ft.; besides containing machinery for instructional use, it includes the electrical engineering lecture room. A dark room for photometric work and supply rooms are located in this building. The lecture room has elevated seats and is equipped with a complete line of illustration models, apparatus and instruments. It contains an electromagnet having a lifting force of two tons. In this room there is a counter strong enough to support any of the smaller machines used in testing. The counter rests on a solid clay foundation. It has a slate top 2.5 in. thick, and is served by a crane of 1000 lb. capacity. Binding posts on the back of the counter are connected through fused knife-switches to mains having their plug terminals on the laboratory switchboard.

The dynamo laboratory contains, in addition to speed counters, rheostats, switches and other small apparatus, a full equipment of generators of varied sizes, motors, instruments, transformers, arc and incandescent lamps, fuse-testing equipment and lightning arresters. The dark room contains a complete outfit for high-potential, high-frequency and X-ray work, and a central-station photometer, with rotating stand, for lamp testing.

The laboratory wiring is carried out on the principle of saving time in making connections that are not instructive in any particular experiment that is to be made, but of leaving to the student all connections that are intimately concerned with the educational value of his work. Heavy mains from the power house make connections to triple plugs on the switchboard. Under the floor are run six heavy circuits. From these, laterals are run to floor boxes furnished with fused knife switches and binding posts. The boards are of slate, let in below the floor level, and covered when not in use by slate slabs. From four binding posts in the floor boxes other laterals are run, conecting to small switchboards on the side walls. These in turn have binding posts and plugs by means of which connection may be made to an overhead system of comparatively small mains run on the ceiling. These overhead mains are joined at intervals to plug boards, reached in making connections by long-handled plug rods.

The main distributing switchboard consists of a slate panel, equipped with ⅝-in. plug contacts. These contacts are about 3 in. long with three splits about two-thirds of the way down, and are soldered into heavy brass terminal blocks secured into the back of the board. Flexible cable soldered into ⅝-in. tapered tubing is used to make the connection. Multiple plug contacts are employed on lines likely to be used at the same time by different experimenters. The small overhead lines are protected by plug fuses, and the larger ones by link fuses on the back of the board. Any line may be plugged through the circuit breakers placed on the side panels of the switchboard.

The electrical instrument laboratory is in a separate building designed specially for the more delicate experiments, built of brick, no iron, steel or other magnetic substance having been used in its permanent construction. It contains, besides elementary apparatus, Kelvin, Queen, Carhart, Wheatstone, Willyoung, Becker, D'Arsonval, Nalder, Rowland and Elliott measuring instruments. All instrument supports are piers specially designed to prevent vibration. A local switchboard is provided to facilitate the making of connections.

The mechanical laboratory is in a substantial brick structure

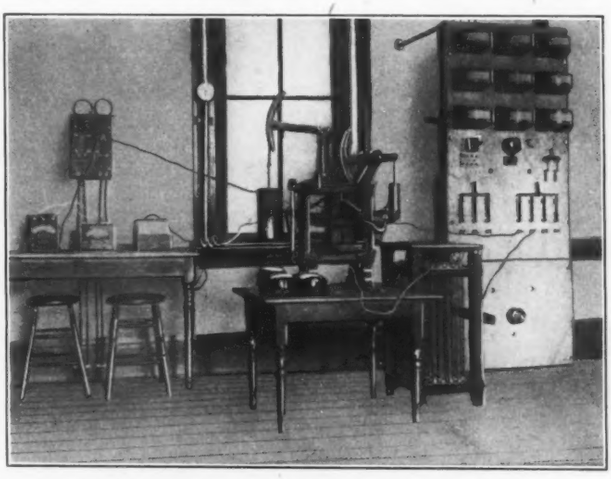


FIG. 4.—TEST OF CONSTANT CURRENT TRANSFORMER.

containing about 30,000 sq. ft. of floor space. On the first floor are the mechanical laboratory section, machine shop, forge shop and foundry. The original power plant was located in this department, and the engine units and the generators are still available for service in the instruction work. The alternator used in this plant has six poles and 36 coils connected in sets of six. The terminals of these sets are brought to binding posts on top of the machine. From these may be had single, two, three or six-phase currents, with the choice of delta or star

connections. In order to make the connections more conveniently, the alternator is equipped with plug terminals and flexible plugs, by means of which phase interconnection may easily be obtained. Accompanying this machine is a set of edgewise indicating instruments arranged to measure two or three-phase power. The equipment of the mechanical division is very complete for the study and testing of engines, boilers, fans, machine tools, forges, condensing apparatus, calorimeters, air compressors, dynamometers, testing machines, injectors, indicators and other equipment most frequently met by the mechanical and electrical engineer industrial establishments. A completely equipped foundry, accommodating 20 students, is in regular service. The tool arrangement and variety in the machine shop are unusually convenient and complete. On the second floor of the mechanical building is a woodworking shop. About 20 electric motors are in service about the college buildings, driving equipment in the different departments.

On the second floor of the mechanical building are offices and recitation rooms, including the study of Prof. Walter Merritt Riggs, E.M.E., director of the department of mechanical and electrical engineering. The top floor of the building is used as a drawing room. About 200 men have been graduated from the mechanical and electrical department since the college began work. Thorough instruction in fundamental principles, with supplementary shop and laboratory practice, has been the policy. The thesis work thus far carried out has consisted mainly of designing in the senior year. In the four years available for undergraduate study it is not expected that any special research can be undertaken, under present-day conditions. The president of the college is Patrick Hues Mell, M.E., Ph.D. The following men are in charge of the divisions indicated: Prof. W. M. Riggs, electrical engineering; Prof. S. B. Earle, mechanical engineering; Prof. T. G. Poats, physics; Prof. R. E. Lee, drawing and designing; Prof. S. T. Howard, machine shop; Assistant Prof. J. H. Hook, wood shop; Assistant Prof. J. W. Gantt, forge and foundry.

General Inspection and Repairing of Service Meters.

By Joseph B. Baker.

In an article which appeared in the May 30 number, the writer described the various preliminary tests made on customers' premises on unsealed commutator-type and induction-type meters with indicating instruments; a tester and helper being employed in making the tests. By this means the general behavior of the meter is ascertained. The instrument should then be given a general overhauling and any conspicuous troubles that may have shown up during the test should be corrected preliminary to and in connection with the recalibration. However, some of the things mentioned below do not have to be done at every "regular inspection." Thus in many companies it is considered that the jewel bearing need not be cleaned (and oiled, if oiling is the custom) oftener than once a year for meters that are operating under normal conditions and that show up well on test.

The following electrical troubles of commutator meters, and their remedies, may be referred to:

If a meter will not run at all, the cause is usually to be found in an open-circuited resistance card or shunt field; in a high-resistance brush contact, or a broken wire leading from the resistance card; or again, in rare cases, an open circuit at the soldered contact at one of the two commutator segments upon which the brushes are found to be resting. These troubles can usually be repaired on the spot. If the break is in one of the sections of the armature winding, the meter will run, even on light load, but will register low through the entire range, because current can pass through only one-half of the armature. Such a break cannot, as a rule, be located and repaired on the consumer's premises, but must have attention at the laboratory.

If a meter runs slowly or unsteadily, or both, on both light load and full load, the trouble may consist of a defective armature winding (open-circuited, short-circuited or grounded) or of a short-circuited pair of commutator segments, and may be located by using a special test lead in circuit with a lamp. This arrangement consists of a convenient length of lamp cord with a lamp connected in on one side, and is to be used by connecting one pair of ends across the voltage leads and exploring the armature with the free ends—which should be terminated in substantial points for the purpose—by touching these ends on one pair of adjacent segments after another, working entirely around the commutator in such a way as to test every armature coil. The shunt field coil should be disconnected from the brush during this test. The free ends of the test lead should be touched on at the points where the leads from the armature coils are soldered to the commutator segments, but not on to the surface of the commutator itself. If all of the segments and armature coils are faultless the lamp will light at equally reduced candle-power at every test around the commutator, owing to the resistance of the armature windings between segments. If, however, the lamp lights up to full candle-power on touching any pair of segments, a short-circuit exists between the two segments on which contact is being made; and this short-circuit, which may be due to a particle of foreign matter lodged between the segments or to a burr projecting from one segment to the other, should be cleaned out with a wood pick or burned out electrically. If the short-circuit is in the winding, the trouble will probably have to be cleared at the laboratory. If the lamp does not light at all, it shows an open coil in the armature, requiring the armature to be rewound at the laboratory; or an open circuit in one of the leads from segment to armature or in the soldered contact at one of the segments, either of which troubles may be cleared on the spot.

If the shaft is observed to be bent, it will usually have to be removed to the laboratory to be straightened.

A bend in the shaft, due to a blow or stress from any accidental cause, will usually be in one of two places: at the top where the shaft terminates in a journal of small diameter running in the upper bearing, or at the shoulder where the shaft is turned down to fit the hub of the disk. A bend at the top, which might cause friction or jamming between the worm and worm wheel, may be detected by lifting the top bearing until it encloses the extreme upper end of the shaft. Upon twirling the shaft, a bend at the shoulder between the journal and the shaft, even if very slight, will cause a noticeable wobbling of the shaft. A bend at the shoulder above the disk hub will be revealed by the running of the disk "out of true."

The tester should remove and examine the jewel, clean it out thoroughly—a pointed stick covered with clean chamois answers well as a cleaner—and test it by passing a sharp steel point over its bearing surface (the "needle test," as used in the inspection of meter jewels in the process of manufacture), taking care not to bear on too heavily, as by so doing the jewel may be scratched, especially if it be a sapphire. Too many jewels should not be tested with the same needle, as the latter may become blunted in contact with the hard jewel surface, so that minute imperfections cannot be detected with it. If the jewel shows any sign of being cracked, or roughened, it should be replaced by a new one, the pivot being changed at the same time (in meters having a renewable pivot). Damaged meter jewels may be replaced by sapphire jewels of the original design, or (in pivot-and-jewel meters) by diamond jewels. The replacing of a sapphire by a diamond jewel, or the inspection of a diamond jewel already installed, involves the taking of special notes for the record of the test, to afford the central-station company data on the behavior of diamond jewels in service.

The shaft-end should be examined with a magnifying glass. In meters in which the shaft-end is not removable, if the shaft-end is scratched the shaft must be replaced at the laboratory. In order to avoid rusting or scratching of the shaft-end or pivot, it should not be touched or handled with the fingers, but

only with clean chamois or soft wood. In removing a pivot, after removing the jewel screw (or post) from the meter, start the pivot with a solid wrench and remove it with a spring wrench; and in replacing the pivot, or putting in a new one, use these tools in reverse order. In this way any risk of dropping the pivot will be avoided. Immediately upon removing the pivot with the spring wrench, it is a good plan to screw it into the end of an old meter shaft, so that it may be examined without handling. In inserting the new pivot or removing the old one care must be exercised not to spring either the shaft or the disk.

In the practice of many companies, if the meter is in a damp location the jewel and pivot are oiled, using only a very little watch oil of the best quality, to lubricate the jewel bearing and prevent the pivot from rusting. A mere trace of oil is sufficient—all surplus should be wiped off. An excessive amount of oil is likely to produce a clogging effect by collecting dust, or thickening, and should be avoided.

After the jewel is put back in place, the tester should see that the worm is opposite the center of the register worm wheel with which it meshes; loosening the lock-nut on the jewel screw (or bushing) and raising or lowering the shaft to bring it so, if necessary, in meters designed with the worm on the meter shaft. Before loosening the lock-nut, however, the jewel should be screwed up tight, as otherwise it will be likely to turn in the bushing and give rise to much trouble. When the worm and worm wheel are properly meshed, the top bearing should be cleaned and adjusted if necessary so that it is at the right height and free from binding.

The top bearing may be cleaned by inserting a small stick of soft wood and twisting it about in the hole. The hole should fit the shaft—neither so worn as to permit the worm and worm wheel to jam, nor so small as to cause friction. After cleaning, blow through the hole with the air syringe. The top bearing should be set to enclose about one-half of the length of the small-diameter upper end of the shaft. After this adjustment is made, the shaft should be pushed downward against the jewel spring to make sure that the end does not come out of the top bearing when the jewel spring is fully compressed. In adjusting the height of the bearing, if a set screw is used it should be loosened, thus leaving the stud free.

Opinions differ as to the advisability of oiling the top bearing. Some meters are made with a top bearing consisting of a fixed journal, running in a hole in the top of the shaft and designed to be lubricated from a minute oil well. In other meters the top bearing plug constitutes a chamber, air-tight at the top, which may be filled with oil, the latter forming a cushion around the top of the shaft, which prevents rattling at this point (as in alternating-current meters) and also prevents rusting of the top of the shaft. Care should be taken not to use too much oil—especially in the top bearings of commutator meters—as any more than will be held in the bearing by capillary attraction is liable to creep down the shaft in time and cause trouble.

If in making adjustments the disk is displaced from its proper position midway between the magnet poles, it should be brought back to this position by shifting it up or down on the shaft.

The register, cursorily examined at the beginning of the inspection of the meter, may now be overhauled thoroughly. The friction in the train may be enormously increased by dust, dirt or verdigris, by bent wheels or teeth, or by burrs on the teeth, due to rough usage. Special attention should be given to the worm and worm wheel, to see that they are clean, and that they mesh properly and run without bending or undue friction. The amount of play between the worm and worm wheel and between the other wheels of the train may be determined by testing with the finger. Each wheel and pointer should be examined separately, and known to be clean, true, uninjured and fast on its shaft. The pointers should be ascertained to be standing in their proper relative positions on the dials by spinning the train so as to bring the pointers to a simple (easily deciphered) dial reading.

The importance of keeping the register free from troubles that mean friction may be realized by bearing in mind that the aggregate gear and bearing friction of the trains of wheels may easily become very high compared to the total friction of the moving element of the meter. A bent wheel tooth or a clogged bearing, especially on one of the low-reading dials, may result in slowing down or actually stopping the meter. The entire register, including the dials, should be cleaned with benzine if necessary, or removed for cleaning at the laboratory if verdigris is present. Whether the bearings should be oiled is a matter on which opinions differ. In any event, only a trace of oil should be used. The worm may be cleaned with a tooth brush, or by twirling the shaft while pressing the sharpened edge of a piece of soft wood against the worm—not too hard for fear of bending the shaft—allowing the convolutions of the worm to cut into the wood, with the grain.

In the inspection of commutator meters, the handling of the commutator and brushes is a matter which should be approached with the greatest caution, as it is easy to ruin the accuracy of the meter by ill-advised tinkering.

In commutator meters the commutator is considered by many meter experts to be the weakest point, and the one feature above all others which has been the cause of most inaccuracy in operation. It should be borne in mind that while a carefully designed and constructed modern watt-hour meter possesses the same inherent accuracy for the measurement of power that the electro-dynamometer possesses for the measurement of work—being, in fact, a rotating electro-dynamometer in which the directions of the fields of the fixed and moving coils are maintained in the position for constant (maximum) torque by means of sliding contacts at the commutator and brushes—this accuracy is subject to serious disturbance in practice by variable electrical and frictional resistances at the commutator and brushes. The commutator, in which the electric meter departs most from the laboratory standard of precision, is at the same time the very part which can least afford, so to speak, to be carelessly or negligently handled. When it is considered that under the exigencies of commercial meter work the commutator must be allowed to go for long periods exposed to variable and abnormally severe conditions, from a laboratory point of view, and without any attention, it is readily seen that without the utmost care and skill in maintaining this vulnerable point of the electric watt-hour meter, it is as unreasonable to expect acrate results from the meter as it would be to expect accurate indications from an electro-dynamometer the moving coil of which had a loose contact of varying electrical resistance and bearing supports of varying friction. Moreover, this inherent weakness of the watt-hour meter is made more serious by the fact that the meter is not a deflecting instrument, merely giving instantaneous values, but a rotating instrument, giving integrated values; so that the error due to functional disorder at the commutator is cumulative in effect.

Many meter experts agree that under no circumstances should the commutator be cleaned unless it is very rough, and sparking too badly to be stopped by pressing the brushes lightly on the segments while revolving the shaft or by very slightly increasing the tension; or unless it is tarnished so badly as to be inoperative. When the meter is first installed, the tension should be adjusted for the local conditions and should not be changed thereafter, unless the conditions change; as by so doing the small grooves which wear into the brushes would be slightly moved from their seat on the commutator, thereby setting up sparking, and this sparking once started would tend to increase by the burning and roughening of the commutator.

Examination and handling of the brushes are facilitated by the special brush tool which comes with the meter-tester's kit, and by holding a piece of white paper or a lamp back of the commutator. A good test of the brush tension under ordinary conditions is to spring the end of the brush away from the commutator about ⅜ in.—using a knifeblade or small screwdriver so as to bear on the brush fingers evenly—and then allow the brush to fly back against the commutator. If the tension is right, the brush will neither slam down hard on the commutator, which would indicate too heavy a tension, nor jingle against it, which

would indicate that the tension was too light. If the brush tension needs to be increased, a good way to do so is to place the special brush tool against the brush at the point where it is coiled around the stud and press it in far enough to give it the right amount of "permanent set." In adjusting the tension, the pressure should not be applied at the free end of the brush, as doing so is liable to bend the brush or the individual fingers out of the vertical plane. The fingers should lie naturally in the same vertical plane—i. e., when the brush is lifted from the commutator by outward pressure at a point near the stud—so as to bear on the same element of the commutator for the full width of the fingers. The brush tool can be used to correct the alignment of the fingers, whether they are twisted out of the vertical or bear on different elements of the commutator.

A moderate tension of the brushes—neither so heavy as to bear on the commutator with excessive friction, which would not only introduce friction error, but bring on sparking and its attendant troubles, nor so light as to risk springing away from the commutator under vibration, which would also cause sparking—will usually give the best satisfaction in the long run. The tension should be kept as nearly equal on both brushes as possible, so that the wear will be reduced to a minimum. If the meter is supplied with a sufficiently powerful adjustable shunt-field coil, by which to compensate for increasing resistance of the armature circuit due to tarnishing of the commutator and consequent lowering of speed, the brush tension will have to be changed only in very rare cases. Less trouble will be experienced with light-load readings if, in testing the tension, the brushes are handled very gingerly, so as to avoid disturbing their seat upon the commutator.

In cleaning the commutator and brushes it is generally agreed that nothing which is more abrasive than partly worn crocus cloth should ordinarily be used.

It was formerly thought necessary to give the commutator and brushes a thorough cleaning at every inspection, but it is now believed by many experts that such frequent cleaning is a mistake, and that the commutator and brushes should be interfered with as little as possible, after having once been properly adjusted at the time the meter was installed. The subject is intimately connected with the proposition that a meter after being carefully calibrated under the special facilities of the test room should have its final adjustment and calibration done at its place of installation, so as to start right under the local conditions of vibration, dust, moisture, temperature variations, etc. In a meter which has been properly adjusted on the consumer's premises, and which is carefully and systematically inspected—the commutator ascertained to be true, smooth and clean, and the brush tension skilfully adjusted to the local conditions of vibration—the commutator and brushes will ordinarily give little trouble. The commutator will tarnish (more or less rapidly, according to local conditions) so as to require occasional readjustment of the shunt-field coil to compensate for the increased resistance between brushes and commutator, but will develop a smooth surface which will gradually reach a permanent state, if left undisturbed, not unlike the permanent oxidized glaze which is acquired by the commutator of a well-cared-for generator or motor. Sparking will be unknown, since the meter is kept free from dust, and since the brushes, having been properly adjusted at the start, never either cut into the commutator on the one hand, or, on the other hand, spring away from it under the vibrations to which the meter is subjected.

Crocus cloth should only be used in extreme cases, when excessive sparking due to unusual vibration which had not been allowed for in the original adjustment at the time of the installation of the meter, or excessive tarnishing due to severe conditions of moisture, temperature, etc., are found, requiring thorough dressing down of the surfaces of the commutator and brushes and the readjustment of the brush tension and of the shunt-field coil, i. e., the beginning of an entirely new chapter in the service history of the meter.

When the condition of the commutator or brushes, or both, is such that cleaning is seen to be necessary, a piece of cotton tape or webbing (an ordinary corset string answers nicely) should be used before resorting to anything which could be called an "abrasive." A shoestring, sometimes used, is not as good for the purpose, as it contains sizing and dye, which are liable to cause trouble. Whatever is used should also be free from lint, which may catch between the segments. The contact surface of each brush may be gone over with the tape stretched over a thin, flat stick—rubbing lengthwise of the brush, and taking care to avoid bending the brush. The commutator may be given the same treatment by passing the piece of tape around it and then pulling or "sawing" the tape back and forth so as to twirl the meter shaft, thereby polishing the commutator in the bight of the tape, taking care to pull gently so as to avoid any risk of bending the shaft or injuring the jewel by too strong a side-pull on the shaft. In cleaning the commutator, care should be taken to avoid turning it out of its original position on the shaft. The angular position of the segments with relation to the sections of the armature winding to which they are connected should remain unaltered, as any shifting will shift correspondingly the point of commutation of the meter and thus alter the calibration. The air syringe may be used to remove all dust or other particles that might cause trouble. If the condition of commutator and brushes is so bad, through excessive tarnishing or roughening, as to require the use of an actual abrasive to put them into shape, a piece of worn crocus cloth may be substituted and used in the same way as the tape. Brushes which are in very bad shape may be smoothed with a fine file (taking care not to touch the commutator), followed by the crocus cloth. Carborundum cloth may also be used.

After going over the commutator and brushes as much as may seem necessary, and adjusting the alignment and tension of the brushes, the seat of the brushes on the commutator may be tested by pinching the pair of brushes very lightly between the thumb and forefinger of one hand and twirling the meter shaft between the thumb and forefinger of the other hand. In doing so, any roughness of the commutator, whether due to roughness of the surface, high segments or foreign particles, will be felt through the brushes. If there is not room to get at the brushes with the fingers as described, the inequalities may be felt almost as well by bearing lightly on one brush with the finger or with a thin implement held in the fingers. This operation not only detects inequalities in the commutator, but helps to establish a permanent seat between the newly cleaned and adjusted commutator and brushes by dislodging foreign particles and wearing an incipient groove in each brush, with a corresponding path, or contact zone, around the commutator.

Very many of the troubles experienced in adjusting the brushes have been lessened or eliminated by the gravity-control brush arrangement with which commutator meters of the most recent type have been equipped. The great advantage of the new arrangement is that no tinkering of the brushes is required, and that the adjustment, once made, by a simple thumb-nut arrangement, need not be disturbed. It should be stated, however, that gravity-control brushes are susceptible to vibration troubles, causing sparking at the commutator, for vibrations of certain frequencies in unison with the natural period of the brush rig.

The general caution in regard to the maintenance of the commutator and brushes may be summed up by saying that it is rarely necessary to clean the commutator unless it is very rough or very dirty, or blackened, due to sparking or oxidation; and rarely necessary to clean the brushes if there is no sparking, as it is inadvisable to disturb the contact surfaces of commutator and brushes. There should be no current on the potential circuit during the work on the commutator or brushes, as sparking and consequent damage to the contact surfaces are apt to result.

The entire meter should then be given a general inspection, cleaning the disk, magnets, register, dials, etc., if necessary, and ascertaining that the binding posts are well set up.

It should be noted whether the series field coils show any

signs of overheating by short-circuit, or overload, such as blistering or discoloration of the shellac. If any such evidences are found, special attention should be given to the damping magnets, in connection with the calibration of the meter, to ascertain whether they have become weakened or demagnetized by the stray field due to the short-circuit or overload; and the consumer's load should be investigated to see whether it does not exceed the capacity of the meter.

If the meter is of an old-style commutator type without adjustable shunt-field coil, such a coil should be put on.

In installing adjustable shunt-field coils on an old meter, remove the old stationary shunt-field coil carefully, leaving the inside of the series-field coil thoroughly cleaned of any projecting "fins" of the old shellac and mica or other insulating substances with which it may be coated. Place the adjustable coil in the meter and connect it up, making sure that it is connected with the right polarity by moving it near enough to the armature, temporarily, to make the latter rotate on no-load. The shunt should be connected for about five minutes in order to attain its normal running temperature in the meter, before calibrating the meter on light load.

A trouble sometimes found in induction meters, of minor importance, yet often annoying to the consumer, especially in residence installations, is a humming or rattling sound in the meter—sometimes both sounds—due to vibration set up by the alternating current. The former sound is made by loose laminations in the iron core and can be remedied by tightening up the laminations. The rattling is usually caused by lateral movement of the top of the meter shaft in its bearing, and may be overcome by the oiling of the bearing referred to above, or by substituting a wooden or fiber bushing for the brass top bearing (bushing or shaft-end) with which the meter is equipped at the factory.

New Telephone Patents.

SWITCHBOARD APPARATUS.

It has been universally recognized that the switchboard cord is about the most vulnerable part of a manual switchboard, and it is also known that the weakest part of the switchboard cord is at the base of the plug, where it is subjected to abrupt bends

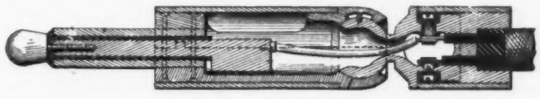


FIG. 1.—SMITH PLUG.

and twists. In order to overcome this difficulty, E. L. Smith, of Oak Cliff, Tex., has invented a plug with a ball and socket joint at its base, one member of this joint being the plug body proper and the other member being the cord terminals. The idea is well given in Fig. 1, which shows a plug and cord in section.

It is now common practice to furnish all telephone exchanges of considerable size with various interrupted currents to provide audible signals for the operators, in order that they may distinguish between different lines, tests, etc. Where there is a ringing generator used these interrupters are commonly mounted so as to be driven by it, but C. J. Erickson, of Chicago, Ill., has now patented an interrupter device of the vibrator type. The vibrators of these interrupters are tuned to different periods, so as to furnish with one a high pitched tone and with the others slow interruptions to differentiate between the various signals. The whole apparatus is designed to run automatically and furnish the signaling currents continuously.

IMPROVEMENTS IN DESK STANDS.

H. L. Knight, of Cleveland, Ohio, has obtained a patent for a desk stand set in which the switch springs are placed vertically within the body tube and the plunger is operated by a substantial vertical rod, secured at one end to the switch lever and guided at the other end by an insulated plug. This rod is surrounded by a spiral spring which operates the lever upon the removal of the receiver. This design affords a very compact arrangement of the parts.

TELEPHONE SYSTEM FOR FIRE HOSE.

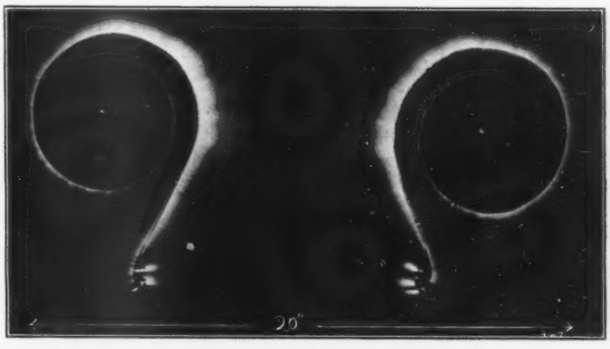
It has been many times suggested that a distinct advantage might be obtained in the fighting of fires, especially in providing for greater safety of the firemen, if some method of extending a telephone line could be devised so that wherever the firemen went with the hose it would be possible to communicate with them. To this end, H. Groswith, of Philadelphia, Pa., has patented the means of carrying forward such a circuit. He imbeds within the body of the hose the telephone wires and at each hose coupling provides registering contact plates so that the telephone circuit is automatically extended as lengths of hose are attached or detached. It seems probable that with such a system perfected many lives might be saved at fires by warning firemen of conditions which they cannot see when within burning buildings, but which are evident to those outside.

LETTERS TO THE EDITORS.

High-Frequency Discharges.

To the Editors of Electrical World:

SIRS:—It is believed that the discharge represented in the accompanying illustration should prove of interest as showing the effects of employing a frequency estimated as 10,000,000 cycles per second—a value greater than appears to have been used previously. Use was made of an induction coil, differing only



HIGH-FREQUENCY DISCHARGE.

slightly from the ordinary kind, having a 1.5-cm spark-gap and a 0.009-mf condenser in its secondary. The secondary coil, which is a modified Tesla, excited a tertiary, across the terminal of which the discharge formed.

It is probable that the discharge was not due to secondary emission or condensation because the "brush" did not change its form when a plate glass 2.5 cm in thickness was placed between the terminals in the path of the discharge. All of the coils and apparatus were designed by the writer and made on the premises. It would be interesting to learn if any other worker has employed a tertiary for the purpose indicated.

RUTHERFORD, N. J. LEO DAFT.

Underwriters' Inspection.

To the Editors of Electrical World:

SIRS:—I have read with much interest the editorial on "Electrical Inspections" in the issue of May 30. The important point brought out, it seems to me, is the value of electrical inspection to the small central station.

During five years' experience as an underwriters' electrical inspector in the Northwest, I have, almost without exception, found the larger central-stations in favor of inspection, while those not openly supporting it have in no way opposed it. On the other hand, the small central-stations have almost invariably opposed inspection, some managers doing everything possible to discredit inspection with consumers.

This opposition is generally based on the idea that enforcement of National Electrical Code requirements retards the growth of business. I do not believe that such a conclusion is justifiable. Good service is just as essential to the success of lighting companies in small towns as it is in the cities, and anything that tends to improve the service cannot be otherwise than beneficial to the central-station, be it large or small.

Poor wiring, aside from the fire hazard involved, generally means poor service to the consumer. If the lighting in a store be shut off by the blowing of a fuse, it is just as annoying to the owner of that store as though the entire stations were shut down for the time being. The consumer, not being familiar with causes and effects in electric current supply, usually does not recognize the cause to be his own poor wiring, for which the lighting company may in no way be responsible, considers only the effect, and charges it to "poor service."

It is to be regretted that more managers of small central-stations do not realize the importance of good interior wiring and the beneficial results of electrical inspection based on enforcement of National Electrical Code requirements.

Butte, Mont. W. T. Jackson.

The Single-Phase Commutator-Type Motor.

To the Editors of Electrical World:

Sirs:—I have read with great interest the paper presented by Mr. B. G. Lamme presented before the Philadelphia section of the American Institute of Electrical Engineers at its February meeting, entitled "The Single-Phase Commutator-Type Motor."

Without any doubt Mr. Lamme was the first to appear as sponsor of the single-phase commutator motor for traction. However, it is worth noting that quite a development of this type of motor was proceeding at the same time, and altogether independent, of Mr. Lamme's work.

In this connection I beg to be permitted to point out the main points in the active work of the writer in the development in order to avoid the possible repetition in future of a publication similar to the one referred to above in which the data concerning the pioneer work done in this field are altogether incomplete.

At the present time three types of single phase commutator motors are on the market; namely, repulsion motors (compensated or not), series motors and series-repulsion motors.

Repulsion Motors.—It is to-day admitted that the writer was the first to point out the automatic development of a rotary field in the plain repulsion motor, and the good commutation which is the result thereof. (See *Electrotechnische Zeitschrift*, June, 1903.) I was thus the first to point out the special points which will decide the future of the repulsion motor. As regards the compensation of repulsion motors, it is also recognized that I was the first to discover the property of short-circuited brushes in suppressing the self-induction of a rotor having a commutator fed by single-phase current. (See *Industrie Electrique*, May 10, 1902.) Further, I communicated to the General Electric Company, before a patent was applied for in any country, the series connection of the compensated-repulsion motor.

Series Motor.—Contrary to what Mr. Lamme appears to think, it was not the Siemens-Schuckert Werke which first had the idea of employing auxiliary poles excited by a lagging current. The chronological order of the patents regarding this question are herewith tabulated and given below as follows:

German Patent of Behn-Eschenburg (Oerlikon)	March, 1904
French Patent of Latour	April, 1904
British Patent of Milch	May, 1904
German Patent application of Richter (Siemens-Schuckert Werke)	July, 1904

Series-Repulsion Motor.—It is sufficient for the writer to call attention to his U. S. Patent No. 841,257, assigned to the General Electric Company, relating to the general form of this motor, as well as to an article which appeared in the *Electrotechnische Zeitschrift* of Feb. 1, 1906, which gives a full account of its detailed theory. It will be seen, therefore, that the writer's name is intimately connected with the development of this motor.

Paris, France. Marius Latour.

Insulating Couplings.

To the Editors of Electrical World:

Sirs:—In your issue of May 23, on page 1113, is an article describing a form of insulating coupling. Possibly there are many readers who have never seen, or even heard of, such a device, and it may be of interest to them to know that a coupling of this description was designed and adopted as a standard by the British Thomson-Houston Company, of Rugby, England, about four or five years ago, the only difference being in the ring used to hold the rubber buffers in place. The diagram shows this to be apparently bent up from square rod, whereas the ring used in the Rugby design is cut from sheet steel.

If my memory serves me correctly, the coupling was originally designed as a flexible device in addition to having insulating properties, but practice ultimately proved that unless the two shafts were lined up with but a very small percentage of deflection, there was an excessive amount of vibration, which, in addition to having a detrimental effect upon the machine, was a source of annoyance to the buyer.

In all other respects the results have proved entirely satisfactory, and a large number are now being used and have been in operation for a sufficient length of time to prove their efficiency, on three-phase, high-tension motors, of from 60 to 250 hp in cotton mills and places of a similar nature situated throughout the northern counties of England.

It was the rapid growth of the use of a supply of 500 volts and over that gave rise to the need for such a coupling, and consequently the supply was not long in following the demand. There is one potential point that should always be borne in mind by the man responsible for machines to which these couplings are attached, and that is, to keep all trace of oil away from the rubber buffers; otherwise the results will be those that usually accrue when these two antagonists are brought into contact with each other, necessitating an unnecessary expense for renewals.

South Boston, Mass. Fred'k C. Herlan.

DIGEST OF CURRENT ELECTRICAL LITERATURE.

Generators, Motors and Transformers.

Temperature Ratings.—P. M. Lincoln.—With reference to the standardization rules of different countries (see Electrical World, June 13, page 1285), the author remarks that the difficulty in the temperature ratings of American and German machinery is even greater than indicated by the comparative tables, for the reason that the overload capacities demanded by the American purchasing public are considerably in excess of those necessary to conform to the standardization rules of the Am. Inst. Elec. Eng. For instance, the institute rules call for 25 per cent overload for two hours on generators, and at this increased load allow 15 deg. C. temperature rise in excess of that allowed at full load. On the other hand, American manufacturers have, in the past, been producing, and the purchasing public demanding, generators designed to meet specifications calling for 25 per cent overload continuously with 10 deg. C.

temperature rise in excess of the full-load temperature and 50 per cent overload for one or two hours with 20 deg. C. rise in excess of that at full load. This latter condition may be compared directly with the German 40 per cent overload for 3 minutes without any temperature guarantee. This practice of the American public is rather illogical. The American institute requirements are much more logical in this respect. The 15-deg. excess temperature rise allowed for a two-hour 25 per cent overload is, within limits, what may be expected in practice with a logically rated machine. It is urged that the American public should be educated to accept the reasonable method of rating generators laid down by the standardization rules of the Am. Ins. Elec. Eng.—*Elec. Jour.*, June.

Lamps and Lighting.

Twisted Filaments.—A note on a recent British patent of A. G. Bloxam (Siemens & Halske Company). The manufacture of metallic-filament lamps of various candle-powers may be facilitated by the employment of two or more filaments twisted together to form one filament of lower resistance and higher candle-power. Standard bulbs and supporting frames may be used for lamps of various candle-powers. A twisted filament has more surface than a single filament of equal section, and is thus shorter for a given candle-power. The twisted filament may be embedded in a ductile metal, and drawn out, if necessary, the outer metal being afterward removed chemically or by fusion. With thick filaments, excessive heating of the supporting hooks is liable to occur. With twisted filaments, however, this can be avoided, as only one strand of the twisted filament need be passed over the hook.—Lond. *Elec. Eng'ing*, May 14.

Leading-In Wires.—A note on a British patent of Bastian, Calvert & Sanders. As a substitute for platinum for the leading-in wires use is made of a pure copper conductor in the form of a very thin ribbon (0.004 in.). This ribbon is provided with a surrounding tube of enamel, glass or soft white "platinum flux" glass, which is fused round that portion of the conductor which is to be fused on to the ribbon by the action of two oppositely directed blow-pipe flames. Not only are all gases excluded from the film between the coper and the soft glass covering, but oxidation of the metal is prevented, and a gas-tight seal is obtained.—Lond. *Elec. Eng'ing*, May 14.

Generation and Transmission.

Electric Motors in Mines.—Electric motors are now introduced extensively in collieries in the northeast of England. The Tribley installation is described. It consists at present of a winding gear receiving energy through an Ilgner converter set; a surface haulage gear for transporting tubs of coal from the new pit head to the old colliery; an electrically-driven fan for providing ventilation in the mine, and a certain number of lamps on the surface and in the workings. Moreover, there is in working order an underground haulage system along one of the main roads, although in two or three directions the work of bringing the coal tubs to the pit shaft is accomplished by means of gravity owing to the natural dip of the seam. The Ilgner converter set consists of a 440-volt, three-phase motor running at 1200 r.p.m. and a direct-current generator of interpole design capable of giving any e.m.f. between zero and 300 volts and a current of 167 amp. At the outer end of the shaft is mounted the exciter for the direct-current machine, and the whole of the control of the winding motor is regulated by varying the field excitation of the dynamo of the Ilgner set. The fly-wheel weighs 900 kg and has a diameter of 4 ft. 11 in. When revolving at 4300 r.p.m., considerable energy is stored in it. The winding gear consists of a single-drum winder, 8 ft. in diameter, geared to a direct-current shunt-wound motor designed to carry 167 amp at an e.m.f. of from zero to 300 volts. It is a 12-pole, shunt-wound machine, with field coils specially arranged in sections so as to give large heat radiating area; when taking full current it develops 60 hp. There is no regulating rhéostat in the field circuit of this motor, and the Ilgner set, generator and this motor are connected up solidly together by means of cable with only an overload circuit-breaker in series. The duty of the winder is to lift 800 tons of coal per shift of eight hours, or rather, it has to draw that amount of coal in seven hours, one hour being required for changing men. The tractive effort has a very slight effect on the energy supply system. The method by which this closeness of regulation is obtained is by means of a slip regulator placed in series with the primary of the motor of the Ilgner set. This slip regulator consists of a liquid resistor in each phase lead of the supply system, the position of whose movable plates is determined by the balance of what is virtually a torque dynamometer. The dynamometer consists of a squirrel-cage induction motor, giving a torque of 1.4-kg-meters when taking 3.8 amp and 190 volts, whose spindle is attached to an arm on which depends the gear holding the movable electrodes of the liquid resistor. Adjustment is made by means of counterweights. Should the current through the primary of the squirrel-cage motor exceed a specified value, it operates against the weight of the electrodes and raises them, thereby inserting resistance in the stator circuit of the motor. The current in the squirrel-cage dynamometer is at all times proportional to the power in the motor of the Ilgner set. It follows, therefore, that when the demand on this motor becomes excessive its speed and output are dropped by the insertion of resistance in the primary and an opportunity is given to the fly-wheel to take up the work by giving out its stored energy. In this way a consistent balance is kept up between the demand of the winder motor, the stored energy of the fly-wheel and the demand on the mains.—Lond. *Elec.*, May 15.

Steam Turbines.—J. M. BAILEY.—An illustrated article discussing the possibilities of further improvements in steam turbines in the following directions: First, reduced specific steam consumption; second, increased peripheral speed; third, simplicity of design with minimum number of moving parts. From a practical standpoint the following points are considered: Accuracy of workmanship and mechanical designs arranged so that expansion and contraction under all conditions of load and steam pressure are provided for in such a manner as not to interfere with safe operation. There are now used in the United States more than 2,000,000 hp in steam turbines for driving direct-connected generators.—*Elec. Jour.*, June.

Motors for Steel Mills.—M. A. WHITING.—The author summarizes the very severe conditions to which electric motors are subjected in steel plants, and describes the characteristics of the design and construction of the various types of direct-current and alternating-current motors developed for this purpose by the General Electric Company.—*Gen. Elec. Rev.*, June.

Traction.

Single-Phase Railway.—An illustrated article on the single-phase railway from Rome to Civita-Castellana, which is the first single-phase road installed by the Westinghouse interests in Europe. The section between Rome and the power house is operated at 600 volts, the remaining section at 6600 volts. The whole line has been in operation since December, 1906. The traffic has increased steadily, and the road is to be extended 24 miles. At the point where the line e.m.f. changes from 600 to 6600 volts, a dead section, 4 m long, is inserted. At the middle point of this section and in line with the other poles, there is placed a pole carrying a porcelain arm which throws the change-over switch on the car as it passes. This switch, which is placed on the roof of the car, is of the two-way type, having one terminal connected to the base of the pantograph and the other two connected to the 6600-volt and 600 volt terminals, respectively, of the auto-transformer. In passing over this section it is not necessary to lower the trolley, as no current is on the car when the switch is thrown. Since the catenary construction is not employed, the government insisted that a sure means of protection against the live end of a broken wire be found. To meet this requirement, a small wire was connected to the trolley wire at the end of the line in Civita-Castellana and brought back on the pole line to the power house. Here it was connected to one terminal of the primary of a shunt transformer, the other terminal being earthed. The secondary is connected to an electromagnet mounted on an oil switch, which is in the circuit of the wire connecting the

power house to the trolley line. To put current on the line, the switch is closed by hand; it is then held in by the electromagnet. To test the operation of this apparatus, a knife switch was put in the circuit; when this switch was opened, the oil switch dropped out immediately, with no perceptible interval of time. In case of a short-circuit on the line, the switch will open on account of the drop in voltage.—Lond. *Elec. Rev.*, May 15.

London.—An illustrated description of recent extensions of the generating station of the Central London Railway. This railway is worked by direct current supplied from a number of substations along the route, which receive energy from the generating station at Shepherd's Bush in the form of three-phase alternating current at 5000 volts and at a frequency of 25 cycles per second. The rating of the former equipment of the generating station amounted to 5100 kw in six 850-kw units. An additional 2000-kw generating set has now been installed. The cost of operation on this road in 1907 was as follows: The total cost of operation was 13.7 cents per train-mile (of which 58.28 per cent was generating station costs, 6.01 substation costs, 32.13 locomotion and 3.58 superintendence). The total cost of running the line was 69 cents per train-mile, so that the total cost of operation was 20.1 per cent of the total cost.—Lond. *Elec. Eng'ing*, May 14.

Installations, Systems and Appliances.

Automatic Protection of High-Tension Circuits.—An illustrated description of the protective system of C. H. Merz and B. Price, which is already employed on about 70 feeder cables, covering a route length of about 200 miles, working at 6000, 12,000 and 20,000 volts, together with 50 substations with an aggregate rating of 50,000 kw of installed plant. It has been

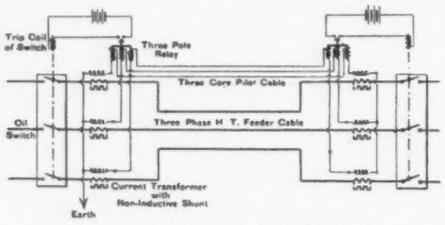


FIG. 1.—DIAGRAM OF CONNECTIONS.

found that under ordinary working conditions a shock on the system at the moment of breakdown has been scarcely noticeable at the power station, and in no case has the synchronous apparatus in the substation been upset. The general principles of the system is that a balance is created under normal conditions between the power which is flowing at the points of entry to and exit from the cable or apparatus to be protected, and means are taken whereby this balance is disturbed only

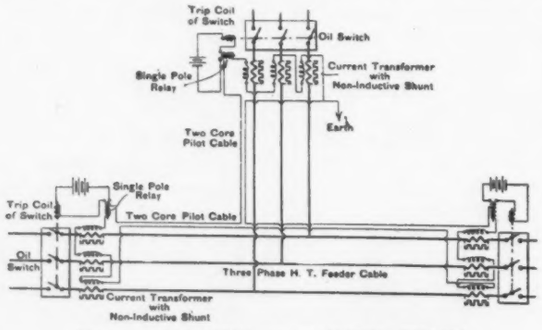


FIG. 2.—PROTECTION OF BRANCHED FEEDERS.

when leaking takes place between the points of entry and exit, due to breakdown. One way in which this system of balance is employed to control the relays may be seen by the aid of Fig. 1, which is a diagram of connections for a simple case of a three-phase feeder cable. A three-core, low-tension pilot cable is laid in the same trough and is connected up at each end to three-phase relays or to three single-phase relays and to the secondary windings of series transformers, the primaries of which are in series with the cores of the main feeder cable. These relays are of the simplest possible character. They act only as contact-makers, and are designed not only to close the local battery circuit instantaneously, but also to release a falling weight, which in turn short-circuits the contact just made. Since the current at both ends of the main cable (neglecting the inappreciable capacity current) must be the same at every instant, it will be evident that unless there is a leakage between the two sets of series transformers the inductive effects which

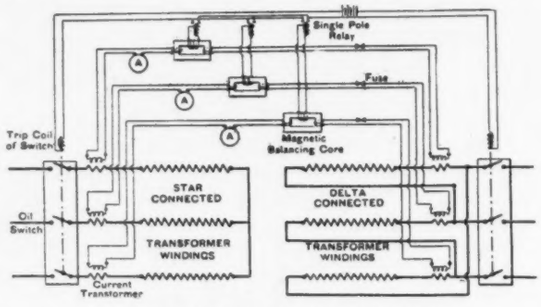


FIG. 3.—PROTECTION OF A TRANSFORMER.

this current will produce in the pilot-wire circuits will be equal and opposite, so that no appreciable current will be produced in the relays. As soon as there is a leakage, however, the balance will be upset, and a current capable of operating the relays will follow. In Fig. 2 is shown the method of protection of branched feeders by means of e.m.f. balancing with an open reverse-delta-connected series transformer. The protection of a transformer by means of magnetic balancing is shown in Fig. 3. As under normal conditions the m.m.fs. in the magnetic balance cores are equal and opposite, the flux is practically zero and the windings, therefore, are practically non-inductive; measuring instruments may be connected as shown.—Lond. *Elec. Eng'ing*, May 21.

Switch-Gear Relays.—C. C. Garrard.—A paper read before the (Brit.) Inst. Elec. Eng., in which the author reviewed critically some principles applied in systems of switch-gear control apparatus and relays for alternating-current circuits. In speaking of polyphase relays he said that they should never be used, but always single-phase relays connected separately on two or three of the phase leads on three-wire or four-wire systems, respectively. Concerning solenoid relays, he remarked that the dashpot solenoid type of maximum relay is not to be relied upon for dealing with intermittent overloads or short-circuits. Fuse-shunted trip coils are cheap, but changing the thickness of the wire not only alters the current at which the combination works, but also affects the time lag enormously. Thus, independent adjustments of the time and the current calibrations are not feasible—at least, if fuse wires of constant length and of the same material are used. The fuse-shunted trip coil may, however, find useful application on motor-control panels where ordinary fuses are not desired, and where a discriminating action, apart from the prevention of the machine being cut off due to every temporary overload, is not wanted. As to maximum relays connected on the "resultant principle," the author stated that the only safe arrangement is to have the same number of relays as there are series transformers. If the circuit be a four-wire one, then three relays are necessary; if three-wire, then only two relays are essential. As to reverse-power relays on generators, the author pointed out that the most suitable value to which a generator reverse-power relay should be set is such that it will operate, after the requisite time lag, with a power reversal of 10 per cent of the full rating of the machine. With this setting, the current which can be produced in the generator windings is never very excessive. At the ends of feeders a reverse-power relay should be set proportionately higher than on the generator; probably if it were set to operate at 25 per cent of the normal full-load rating of the feeder the most suitable arrangement would be obtained. The author then discusses the protection of interconnector cables (for the connecting of one substation with another). The Merz and Price system is briefly described, and the author then

deals with the protection of interconnector cables by means of electrically-interlocking reverse-power relays. As the criterion of failure of an interconnector is simultaneous flow of energy into it at either end, such a circuit can be protected by the installation of reverse power relays at both ends, both relays being connected in a common tripping circuit arranged so that only when energy is flowing into the cable at both ends is the trip-coil circuit closed at both relays and the main switches caused to open the circuit (see Fig. 4). Normally, the trip circuit is broken at one relay and made at the other, or vice versa, according to the direction of flow of energy in the circuit. The relays close the circuit with a slight time lag, so that,

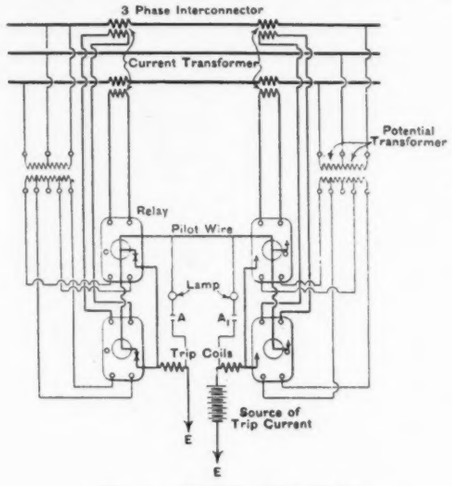


FIG. 4.—SWITCH GEAR RELAY.

on the flow of energy reversing, one of the contacts is opened at the one relay before the other one is closed. A and A_1 are pairs of contacts which are closed automatically when the main circuit-breaker at the corresponding ends opens. Thus, if the switch at the left end of the interconnector opened slightly before the one at the right-hand end, the trip-coil circuit would be closed at A by the relay of the right-hand end. Thus the circuit-breaker at the right-hand end would also operate. The object of this arrangement is to ensure that both ends of the interconnector will be disconnected, even if the two switches do not quite act simultaneously. Each trip coil is also arranged so that it is cut out of circuit when its main switch has opened the circuit, after, however, A (or A_1) has been closed. The trip coils, therefore, are not subjected to danger of burning out. The state of affairs might, however, arise that the left-hand switch was opened and the right-hand switch was closed, there being a short-circuit or earth connection on the interconnector. By the act of closing the right-hand switch the trip coil of this switch will be put into circuit ready for operation, and the circuit through it will be complete through the right-hand relay, which operates due to the flow of energy into the fault, through A. Thus the right-hand circuit-breaker will open, at the same time cutting out its own trip coil. Thus it is impossible to connect up the interconnector at either end while there is a fault. The arrangement as set forth above, of course, necessitates that there should be some voltage in order to operate the relays. If the voltage absolutely disappears, the reverse-power relay will not work, and it may be thought that in the case of a very bad short-circuit this will happen. Considerable experience has shown, however, that even under the worst conditions the voltage does not entirely disappear, and that if the calibration of the apparatus is unaffected by fall of potential down to 10 per cent of the normal working voltage, all working conditions will be met. As the pilot wire carries only the tripping current, it will be seen that only one pilot is necessary whether the relays are single-, two-, or three-pole. On a three-phase system the relays will be two- or three-pole, according as to whether the system be three-wire or four-wire. An account of the extended discussion which followed is also given.—Lond. *Elec. Eng'ing*, May 21.

Tirrill Regulator.—A. SCHWAIGER.—While the Tirrill voltage regulator is being used considerably in practice, theories of it have been developed which often do not agree with the practical results. The author deals with the principles of rapid regulation and first gives a "static theory" of the Tirrill regulator. It is shown that the regulator can be in equilibrium in any position. Nevertheless, it might be possible that when the regulator moves from one position to another position it might not come to rest in its new position. The static theory must, therefore, to be supplemented by the dynamic theory, giving the conditions under which oscillations of the regulator around the position of equilibrium will diminish in time. It is shown that by selecting a proper method of damping it is possible to produce stability in any case.—*Elek. u. Masch.* (Vienna), May 17.

Switzerland.—A. WEBER.—Some statistical notes on the central stations of Switzerland in 1907. There were 539 stations, of which 171 were primary generating stations with a maximum rating of 168,920 kw. As to the capital invested in the hydroelectric stations utilizing waterfalls of different heights, the following figures are given: The average cost per horse-power, including the network, is $174 for waterfalls less than 12 m in height; $196 for from 20 to 100 m; $150 for from 101 to 500 m; $110 for from 501 to 1000 m. Of the 171 generating stations, 56 supply direct current, 18 single-phase current, 35 three-phase current, 33 single-phase and three-phase currents, and 17 direct current and three-phase currents.—*La Lumière Elec.*, May 16.

Switchboard.—An illustrated description of a high-tension switchboard of German make, the special feature of which is the use of removable switch carriages so as to permit easy tests, repairs, etc.—Lond. *Elec.*, May 15.

Relays.—M. C. RYPINSKI.—A continuation of his illustrated serial on protective relays. The present instalment deals with alternating-current overload and reverse-power single-phase relays, operating on inverse-time-element action.—*Elec. Jour.*, May.

Earth Resistance.—R. HAAS.—In Germany the lawn on terraces is often held together by means of a ribbon of sheet iron and this ribbon is said to be very suitable for earth connections, especially since the lawn is always kept wet.—*Elek. Zeit.*, May 14.

Circuit-Breakers.—H. G. MACDONALD.—A continuation of his long illustrated serial on circuit-interrupting devices. The author discusses the general features and designs of oil circuit-breakers.—*Elec. Jour.*, May.

Wires, Wiring and Conduits.

Porcelain Insulators.—C. C. GARRARD.—It is almost universal practice at the present day to use corrugated porcelain insulators for the bushes of transformers, switches and the like. It has been the fashion to specify that these should have certain minimum leakage distances from live metal to earth. In order to conform to the specifications it has often been found necessary to employ very deep corrugations, which increase the cost and make cleaning difficult. These deeply corrugated insulators have been evolved from the ordinary petticoat insulators for outdoor service. In order to find whether these corrugations are really necessary, the author has experimented with the two insulators shown in Fig. 5. A corrugated and a plain insulator having about equal exterior diameters were tested for equal direct distances; that is to say, the direct jumping distance through air, not following the surface of the corrugations, was the same in both cases (about 8½ in.). The two insulators were tested in parallel, and with the corrugated insulator the spark jumped across first, at 80,000 volts (effective). The distance on the plain insulator was then slightly shortened (to about 8 in.) and it was found that this insulator sparked across

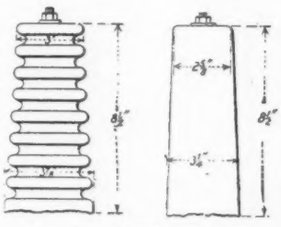


FIG. 5.—CORRUGATED AND PLAIN BUSH.

first. The conclusion which was drawn was that for insulators of about the same outside diameter the corrugations are of no value, and might well be left off, as the determining factor of the breakdown point is the length of the shortest air path. Of course, this conclusion applies only to indoor insulators. Porcelain insulators tend to keep themselves dry and to maintain their insulation, for as moisture is deposited the discharge dries it off. Corrugated insulators have the great disadvantage that it is difficult to clean them and the author concludes that it will be preferable to do away with the usual corrugated insulators on indoor switches, transformers and the like and replace them with simple cylindrical plain ones, designed to have as long a direct air jump as possible. This will result in an appreciable saving in cost. As, however, the corrugated insulator has become a standardized article, an interchange of opinion on this question might be desired before making the change.—Lond *Elec.*, May 15.

Joints.—F. Loppe.—An illustrated description of joints for wires and cables, devised by E. Begot and specially suitable for aluminum. A joint for two wires is illustrated in Fig. 6.

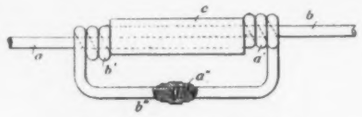


FIG. 6.—TWO-WIRE JOINT.

The two wires *a* and *b* are laid side by side for some distance and enclosed in a sleeve *c*, and the end of each wire is then wound in a few turns *a'* and *b'* around the other wire and the two terminals *a"* *b"* are finally soldered together in some way. The resulting joint is mechanically and electrically strong. A joint for a cable is shown in Fig. 7. The two ends of the cable

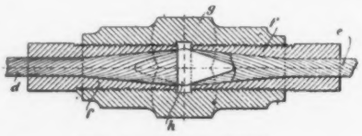


FIG. 7.—CABLE JOINT.

d and *e* are provided with end pieces *f* in such a way that when the nut *g* is turned the two end pieces are brought nearer together. Each of the cable ends is opened out and a double cone *h* is placed in the center. By turning the nut *g* the different wires of the cable are pressed between the double cone piece *h* and the inner surface of the end pieces *f*. Fig. 8 shows

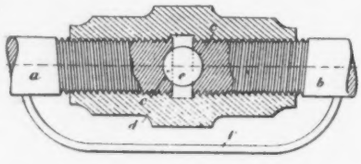


FIG. 8.—JOINT FOR ALUMINUM BARS.

a joint for aluminum bars, such as are used with electric furnaces. The ends of the two bars *a* and *b* are threaded, and between the two ends the sphere *e* is inserted. By turning the nut *d* the two ends of the bars and the sphere *e* are strongly pressed together.—*L'Ind. Elec.*, April 25.

Graded Cables.—C. S. Whitehead.—A note on a (Brit.) Phys. Soc'y paper in which the author examines the formulas given by O'Gorman and by Russell for the "grading" of cables; that is to say, for the required adjusting of the electrical constants of the different layers so that the electric intensity radial to the axis may be constant throughout the covering. The object of the paper was, in fact, to corroborate the formulas arrived at by approximate methods by the authors named, by the rigorous use of Maxwell's general equations. The result is to confirm the approximate formulas, provided that the electrical waves propagated along the cable are not short-waves.—Lond. *Elec. Eng'ing*, May 14.

Suspension of Trolley and Transmission Wires.—R. N. Tweedy.—A paper read before the Dublin section of the (Brit.) Inst. Elec. Eng. on Pringle's tangential system of suspending overhead trolley and transmission wires. The chief features of the system are: 1, the use of two or more non-fouling ears soldered to circular wire at each point of suspension; 2, the attachment of these ears to a bracket arm or span wire by a length or lengths of flexible steel stranded wire; 3, the use throughout of one-piece porcelain insulators. The advantages of the system are pointed out, and tables are given showing the results of tests.—Lond. *Elec.*, May 15.

Electrophysics and Magnetism.

Electronic Theory of Gravitation.—C. V. Burton.—A note on a (Brit.) Phys. Soc'y paper in which an attempt is made to adapt the ether of the electromagnetic theory so as to account for gravitation. Hicks and other writers have supposed that ordinary matter is a modified portion of ether possessing as one of its properties a perpetual pulsatory motion in respect of its volume. It is well known that any such pulsatory objects, placed in a fluid, will exhibit attractions toward one another. The chief outstanding difficulty has been in providing for that agreement in phase which must be assumed to subsist among the centers of pulsatory disturbance. "This difficulty is avoided by the author by supposing all of the pulsations to be caused by primary waves of the compressional-rarefactional type propagated through the ether with a velocity enormously transcending that of light. These primary waves may be traveling in directions indifferently distributed, or predominantly in one direction; but an essential point is that all effective wave-lengths should be very great, measured even by astronomical standards. Taking Lodge's estimate for the density of ether (10^{12} grams per cc), and for the constitutive energy of the ether (10^{33} ergs per cc), the author finds as mathematically reasonable figures the following: Velocity of the compressional waves of the ether $= 7.3 \times 10^{16}$ times the velocity of light; wave-length $= 1.5 \times 10^{17}$ cm; rate at which energy is being propagated through each square centimeter of surface taken parallel to the wave fronts $= 3.4 \times 10^{11}$ kw."—Lond. *Elec. Eng'ing*, May 14.

Contact E.M.F. and Cohesion.—F. Sanford.—An abstract of a Phys. Soc'y paper. In the consideration of the phenomenon of contact e.m.f. in metals, the writer has been led to the conclusion that it is definitely related to the specific inductive capacity, so that a metal having a higher specific inductive capacity will become positively electrified when in contact with a metal having a lower specific inductive capacity. It also seems probable that cohesion, like chemical affinity, is due to electric attractions, and since the electric attraction between two charged bodies is inversely as the specific inductive capacity of the intervening medium, the attractions between the molecules of bodies should vary according to the same law. The above assumptions lead to the conclusion that the voltaic series should be inversely as the cohesion series. Lacking direct data on the cohesion of metals, the author has attempted to test the above hypothesis by relating the voltaic series to the melting points, the expansion coefficients and the hardness of the metals. Apparent exceptions from the rule are discussed.—*Phys. Rev.*, May.

Units, Measurements and Instruments.

Induction Coils.—B. F. Bailey.—The author first considers theoretically and experimentally primary or single-circuit coils without or with an iron core. It is shown that for the highest efficiency the battery should have a rather high e.m.f. and the time of contact should be short, so that the current rises to only a small fraction of the value it would attain if given unlimited time. The break should be reasonably short, but not too brief, especially with a coil having wire of a large diameter in the core, and the core should be made of the wire having the smallest possible hysteretic coefficient. For the sake of first cost, the coil could be made much smaller than those usually employed. The author then discusses the secondary coil, dealing especially with the effect of capacity upon the secondary e.m.f. and with effect of current in the secondary. Finally the efficiency of the secondary coil is investigated.—*Phys. Rev.*, May.

Thermomagnetic Effect.—L. L. CAMPBELL.—An abstract of a Phys. Soc'y paper on the variation of the thermomagnetic effect in soft iron with the strength of the magnetic field and with the temperature gradient. The transversal thermomagnetic effect was first determined in soft iron under a constant gradient of temperature and a varying strength of magnetic field. The temperature gradient was about 18 deg. C. per centimeter, and the magnetic field varied from about 6000 to 12,000 maxwells. The effect increased with, but was not a linear function of, the field strength. The thermomagnetic rotation coefficient Q increased with the field for awhile, and then gradually decreased. For one iron plate, Q had an initial value of 0.00147, a maximum of 0.00150, and a final value of 0.00148. At the higher limit of the field strength, the effect did not seem to approach a saturation value. A second set of measurements was made with constant field strength = 9000 maxwells, while the temperature gradient varied from 15 deg. C. to 65 deg. C. per centimeter. The effect here also increased with the gradient, without being a linear function of it. For the same iron plate, as above, Q increased from 0.00146 to 0.00161, and then fell off to 0.00134. At the highest gradient employed, the effect seemed to approach a saturation value. In the light of the above determinations, it would seem well, in quoting values of the coefficient Q for metals, always to state definitely the field strength and temperature gradient under which the determinations were made.—*Phys. Rev.*, May.

Induction Experiments.—R. T. WELLS.—An account of experiments in which the primary circuit consisted of a uniformly-wound coil with straight axis and circular cross-section and the secondary was a metallic cylinder inside of the coil. The reactions of the core-currents change the effective resistance, inductance and impedance of the coil. The author discusses theoretically and experimentally the effect of such reactions.—*Phys. Rev.*, May.

Telegraphy, Telephony and Signals.

Long-Distance Telephony.—At a recent Royal Society soiree in London, S. G. Brown showed some experiments which may possibly have a most important bearing on the future of long-distance telephony. Current from a high-frequency alternator was passed through a resonating circuit, containing capacity and inductance in series, so that a considerable oscillating current was obtained. Near the inductance was a coil, forming part of another circuit, containing an electrolytic interrupter and a galvanometer. Across the poles of the interrupter was connected a 4-volt battery. Normally the interrupter, which consisted of platinum electrodes dipping in strong sulphuric acid, would at once polarize, but the high-frequency current produced when the circuits were in tune broke down its resistance entirely and allowed the battery current to flow. The tuning of the circuits was so sharp that the approach of a minute piece of iron to the inductance coil of the first made a most extraordinary variation in the inductance in the second, and therefore in the battery current that could flow. The feeblest vibration of a telephone diaphragm would have the same effect, and thus if a receiver were speaking in the field of the inductance coil, another receiver in the battery circuit would reproduce the speech with all the power of the battery behind it. "Thus a simple telephone relay can be constructed and the distance of the transmission of speech increased indefinitely." The alternator used for the high-frequency current gave an output of up to 100 watts with a periodicity of 12,000 cycles per second when running at 6000 r.p.m. "It was of the inductor type, and pleasing both mechanically and electrically."—Lond. *Eng'ing*, May 15.

Wireless Telephony.—A note on a patent of A. Steinacker and A. Plisnier describing some improvements in wireless telephony. It is stated that good results have been obtained by substituting a mercury-vapor lamp for the copper-carbon arc in the oscillating circuit.—Lond. *Elec. Eng'ing*, April 9.

Miscellaneous.

Electrical Power in Iron and Steel Works.—W. E. REED.—A long paper discussing successively the electric driving of auxiliary apparatus, of main rolls, the methods of equalizing reversing mills, with illustrated description of various recent installations. A full account is also given of the extended discussion which followed the reading of the paper.—*Proc. Eng. Soc'y of Western Pa.*, April.

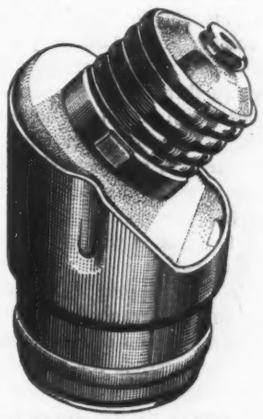
Evening Schools.—W. J. CRAWFORD.—Some notes on the teaching of evening students in engineering. The author discusses at some length the necessary qualifications of the teacher and refers briefly to some subjects to be taught. Other things being equal, the success from teaching engineering subjects will vary directly with the success of the mathematical teaching. "Practical mathematics" (giving the practice of mathematics without the theory) is a "laudable subject," but "it is being shockingly overdone." Teaching in contracted methods in multiplication and division is useless since the slide rule should be in general use. Squared paper work is important, but the proper place for it is after a working knowledge of the simple equation has been acquired.—Lond. *Elec. Rev.*, May 15.

Mechanical Stokers.—J. E. BARNES.—A paper read before the (Brit.) Inst. Mech. Eng. on mechanical stokers as a means of reducing the fuel bill. The author discusses types of stokers, methods of driving, the kinds of coal used, the use of forced draught, operation and upkeep, and gives a description of various commercial makes of stokers.—Lond. *Elec. Eng.*, May 1.

Purchase of Coal.—J. B. C. KERSHAW.—The author criticizes severely the usual methods of selecting coal and of checking the quality of the deliveries under a contract. The only satisfactory way is by means of chemical laboratory tests carried out by chemists who have had experience in this class of work.—*Cassier's Mag.*, May.

Tungsten Lamp Adapter.

The Dale Company, of Ninth Avenue and Thirteenth Street, New York City, has brought out the lamp adapter shown herewith for use on electroliers with sockets set at an angle or with any other angle fixtures. The adapter is intended for use with tungsten lamps, which at the present time are intended to hang vertically, and by its use the ordinary electroliers are serviceable for these high-efficiency lamps. In order that the plug of the adapter may make contact with the socket of the electrolier and at the same time have its own socket vertical, an adjustable strip of copper is provided as shown, and this may be extended or compressed in making the center connection. Aside from the angular feature, the device follows standard plug and socket construction.



TUNGSTEN LAMP ADAPTER.

General Electric Company's Engineering Convention.

For nine days ending June 9 the engineers of the General Electric Company were gathered together at their annual meeting for discussing the past year's development in the art and considering plans for the future. Engineers from the local offices of the General Electric Company throughout the country and Mexico were in attendance, as well as representatives of all branches of the engineering department of the company. Every phase of the company's engineering work was considered in detail. The engineers of the various departments presented interesting papers on a great variety of important subjects.

The meeting was opened at the principal works at Schenectady, N. Y., by Mr. E. W. Rice, Jr., vice-president. After

spending five days at Schenectady the meeting was adjourned to Pittsfield, where Mr. C. C. Chesney, manager of the Pittsfield Works, opened the meeting and introduced the engineers at that factory. The meeting was continued at Lynn, where the engineers were welcomed by Mr. W. C. Fish, manager of the Lynn Works. The company's incandescent lamp works are located at Harrison, N. J., and when the convention assembled at this place Mr. G. F. Morrison, manager, outlined the remarkable development in incandescent lamp engineering during the last year.

Among the engineers from the field present at this meeting were: Messrs. J. Lyman, Chicago; J. L. Monges, San Francisco; W. F. Wright, Denver; H. H. Barnes, New York; C. T. Mosman, Boston; W. S. Culver, Cincinnati; L. F. Deming, Philadelphia; H. E. Bussey, Atlanta; W. H. Hand, St. Louis; C. A. Chase, Mexico.

The Circuit Breaker as Power-Plant Insurance

Some time ago a 500-hp, 230-volt, direct-current inter-pole motor was installed in a textile mill on the first floor, and so connected with rope drives as to transmit power to the second, third and fourth floors of the building. The problem of starting this heavy machine direct connected to a shafting friction load of 20 per cent of normal was taken care of by the use of a specially designed multiple switch starter.

The next problem, that of protecting the motor from excessive overload and stopping it instantly from any of the floors driven by it, was then taken up, and after careful consideration it was decided to use a 2000-amp "LL" type Cutter breaker with overload and shunt trip coil features combined. Lead wires from the tripping coil were run in conduit up through the building with a suitable push-button arrangement in an easily accessible place on each floor, from which the motor may be quickly shut down without any destructive arcing whatever of switch mechanism.

This simple solution of what at first appeared a difficult problem from both a practical and financial point of view, possesses a number of advantages. In this particular case, where there are a large number of machines driving belts and ropes with which employees are liable to come in contact, an instant stop of power from the point where an accident occurs is essential, and is easily accomplished by the use of the trip coil and push-button arrangement. To obtain remote control of heavy current apparatus at a minimum first cost, the use of the breaker with a tripping device was selected after careful consideration.

As the tripping device contains no mechanical features to become disarranged, its positive operation is continued indefinitely. The coil being an auxiliary using but little current, it is not possible for it to destroy itself in any way. As is well known, accidents to driving belts and ropes of a trifling nature are frequently happening in a mill of the character described, which if not immediately checked by stopping operation for a few moments and repairing, develop to serious proportions which require a day or so for repairs. The accessibility of the shunt trip control makes the serious accident next to impossible, as power is shut off immediately at the first sign of trouble, from the room wherein it develops. Quick repairs may then be made and the machines resume operations.

Gas Engine Ignition System.

The distinguishing feature of the ignition system illustrated herewith resides in the use of only one vibrator for any number of spark coils. The coils for automobile engine ignition are placed in a cylindrical, heat-resisting insulating tube which is mounted directly over the engine cylinders. By this construc- the high-tension leads are very short, and the danger of poor insulation between the leads and the engine frame is eliminated. The arrangement of coils and circuits for a four-cylinder engine is shown in Fig. 1.

Although only one vibrator is used at a time, two vibrators are provided. One vibrator is adjusted to produce a heavy

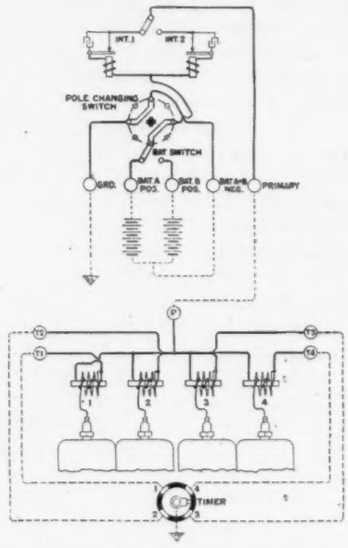


FIG. 1.—CIRCUIT DIAGRAM OF IGNITION SYSTEM.

spark suitable for starting the engine most readily, and the other for a light spark suitable for running the engine when fully warmed up. To prevent uneven wear and pitting of the platinum points of the vibrators, a polarity-changing switch is pro-

FIG. 2.—VIBRATOR BOX WITH COVER REMOVED.

vided in the battery circuit. It is claimed that by the reversals of current the platinum points wear evenly and when once adjusted require no further attention. The two vibrators, together with condensers, the polarity-changing switch, battery

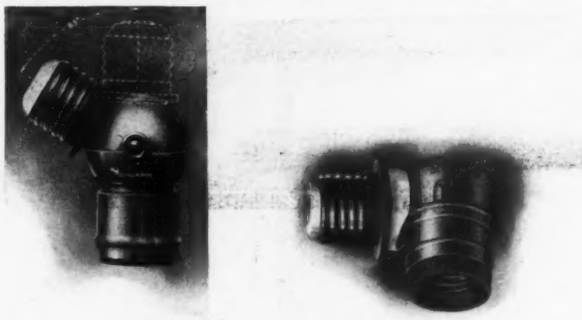
FIG. 3.—FOUR-CYLINDER TUBE.

switch and vibrator-switch are assembled in a box which is mounted on the dashboard of the automobile.

This system has been developed and the equipment has been placed on the market by the Western Electric Company, Chicago, Ill.

New Adapter for Tungsten Lamps.

The Benjamin Electric Manufacturing Company, of Chicago, is placing on the market a new device in the form of an adjustable plug socket, the principal use of which is that of an adapter for tungsten lamps. The device is provided with a rotating sleeve which permits a complete revolution of the socket, together with a hinge joint by means of which almost

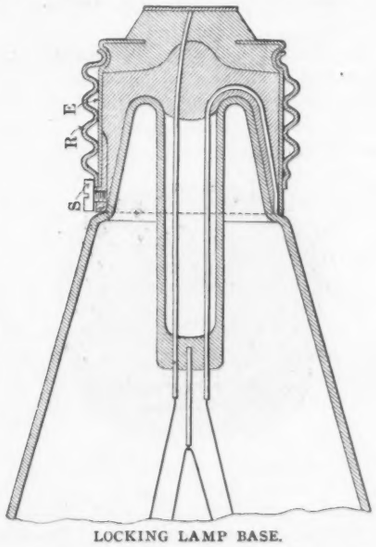


FIGS. 1 AND 2.—ADAPTERS FOR TUNGSTEN LAMPS.

any angle of adjustment desired can be secured. The position of the lamps in a fixture or bracket may thus be changed to the vertical. This device is shown in Fig. 1. Where it is desired to have lamps burn at right angles, that is, with a horizontal socket or receptacle, a second device is furnished. This is illustrated in Fig. 2.

Locking Lamp Base.

With the advent of expensive lamps like the tantalum and tungsten, the necessity of fixing lamps in public places so that they cannot be stolen from the sockets, is being more urgently felt. Even with the comparatively cheap carbon-filament lamp, some concerns lose many lamps by theft yearly. Several socket devices have been brought out to prevent lamp stealing, but the problem has been attacked in a new way in a patent recently applied for by William I. Weber and Walter R. Bonham, 1113 Monadnock Block, Chicago. Messrs. Weber and Bonham propose to use a lamp base such as shown in section in the accompanying drawing. This lamp base has the brass shell *R* which carries the screw threads mounted so that it can revolve freely on inner brass shell *E*, this inner brass shell being cemented to the lamp base in the usual manner. A small set screw *S* is



LOCKING LAMP BASE.

provided, which is screwed down tight, to hold the shell *R* so that the lamp can be screwed into the socket. After the lamp is in the socket, the set screw *S* is removed and the lamp will then revolve freely without unscrewing. To remove the lamp the set screw *S* must be put back. This screw is provided with a left-handed thread. While this is not an absolute preventive of lamp stealing, it is believed that the ordinary lamp thief will not be provided with a screwdriver and left-handed screw of the proper size. Like many other locks, it is easy for an expert to beat, but in a small matter of this kind comparatively few are likely to become experts.

Watt-Hour Meter Tester.

Periodical watt-hour meter calibration is of vital importance to every central station or isolated plant, on account of the fact that the revenue received from the sale of electrical energy is dependent on the accuracy of the meters in use. Although the customary method of testing with indicating instruments

WATT-HOUR METER TESTER.

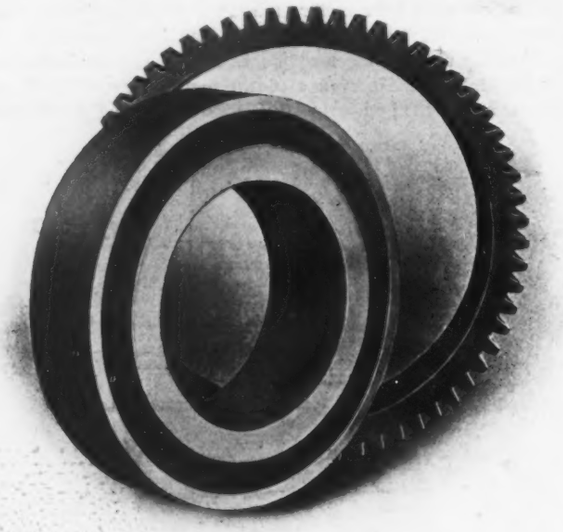
is quite accurate, the rapid growth of the central-station industry has produced a demand for a meter with which these tests can be made more quickly and still retain the same high degree of accuracy. The accompanying illustration shows a meter which has been developed for meeting the demand for a tester for meters on direct-current circuits.

The meter is provided with a register of the three-pointer type. The disk revolutions are indicated directly by the largest pointer on the dial, which can be read to hundredths of a revolution. The two smaller pointers make one revolution, respectively, for each 10 or 100 revolutions of the large pointer. It is, therefore, a simple matter to ascertain the number of the revolutions of the disk by noting the positions of the three pointers at the start and at the finish of each test.

A valuable feature of the meter is the arrangement of the windings by which the torque on the shaft is the same for all combinations provided that in each case the meter operates at the same per cent of its rated full-load. The meter is now offered in two distinct 1-2-10-20-40 amperes or 5-10-50-100 amperes, each with single 110-volt or double 110-220-volt shunt windings, as may be desired. The 1-2-10-20-40 ampere meter has two series windings, one of which is divided into two sections and the other into four. By means of plugs and connection straps these windings may be joined in series or in parallel, thereby affording the five different current ratings indicated. A similar method gives four current ratings to the other meter. It is claimed that the testing meters give commercially accurate registration from a load as small as one-tenth of the smallest full-load rating to full load of the largest rating. This watt-hour meter tester has been developed by the General Electric Company, Schenectady, N. Y.

Removable Rolled Rim Gear.

The illustration shows a new gear for high-speed and heavy-haulage trolley service, now being placed upon the market by the R. D. Nuttall Company, Pittsburg. In conformity with the well-established principle of this company the gear, known as the Nuttall removable rolled rim, was first put to severe tests in actual service. In all of these tests the performance proved exceptionally satisfactory. The rim is made of a special



REMOVABLE ROLLED RIM GEAR.

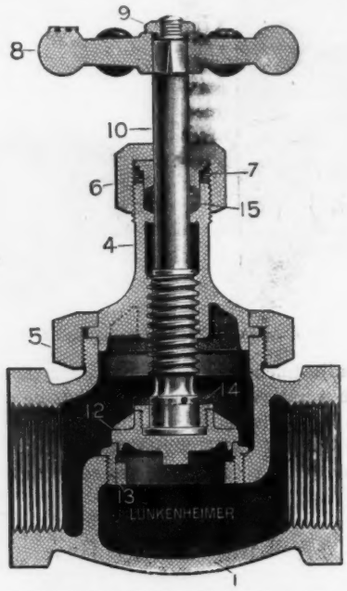
grade of rolled steel of high tensile strength, and is shrunk on a cast-steel center. Thus the two members become practically a single piece. When worn, however, the rim can be easily removed and replaced at nominal cost so as to make a practically new gear. The rim can be attached to any style of center or spider. It is not limited to trolley service, but can be applied to any service where the diameter does not exceed 10 ft.

Renewable Seat Regrinding Valve.

The Lunkenheimer Company, Cincinnati, Ohio., has designed the valve shown in sectional view herewith for the benefit of those who prefer a renewable seat regrinding valve. This valve differs from the Lunkenheimer regrinding valve only in the construction of the disk and seat. The disk 12 is provided with a projecting ring, which enters the valve-seat ring 13. Its principal function is the preservation of the seat, which is accomplished in a two-fold manner. First, as it enters the cylindrical part of the seat it deflects the current of steam from the seat-ring face, preventing the wire-drawing which would otherwise occur. This feature is especially important should the valve be left partly open for any length of time. Secondly, the seating surface is kept free from scale and grit by the action of the thin current of steam discharged over it as the disk is brought home. Another function of this ring is the prevention of water-hammer caused by the sudden admission of steam, for it will readily be seen that no matter how quickly the hand-wheel may be operated, the flange will only permit the steam to enter gradually.

The seat 13 is renewable and can be removed from the valve body by using a flat bar to engage the lugs on the inside of the ring.

The seat may be reground a number of times before it is necessary to renew it. Not only is the seat renewable, but all of the other wearing parts, including the disk, can be renewed if necessary. The hub is securely held to the body by means of a union ring, which makes it impossible for the hub and the body to become corroded together, as the thread which holds the union to the body is protected at all times from the action of the steam, the joint being made between the flange on the hub and the neck of the body. This connection also acts as a tie or binder in screwing over the body, and tends to strengthen the valve. The stuffing-box can be reached under pressure when the valve is wide open, as a shoulder on the steam, directly above the threads, forms a seat beneath the stuffing box. All valves above the ½-in. size have a gland follower in the



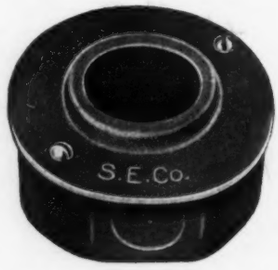
RENEWABLE SEAT REGRINDING VALVE.

stuffing-box. The valves are made to withstand a working pressure of 200 lb. They have either screw or flange ends.

To regrind the valve the union ring 5 is unscrewed, the trimmings taken from the body. Then a little powered sand or glass and soap or oil is placed on the disk, and a wire or pin inserted through the slot in the disk locknut and hole in the stem. The trimmings are then replaced in the valve body and the valve reground, leaving the ring unscrewed so that the hub may rotate in the body and act as a guide for the stem while regrinding.

Octagon Outlet Box.

The Sprague Electric Company has recently put upon the market an improved stamped steel outlet box, which is known as Octagon Box No. 6250. This box, which is a departure from former practices in the stamped steel line, overcomes the defects of partial contacts between bushings or locknuts and



OCTAGON OUTLET BOX, WITH RECEPTACLE COVER.

curved surfaces of round boxes, since the flat sides give full contact, while the round corners save space. The box is smaller than a round box of the same diameter or a square box of the same width. A full line of standard covers are furnished in galvanized or black enamel finish, and covers can be had in old brass, oxidized copper, polished copper and nickel finish. The covers are interchangeable with standard ¾-in. round boxes.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Irregularity in weather conditions in the principal crop growing sections of the country prevented any marked development in trade during the past week. It was too wet and too cool for satisfactory crop maturing in the Southwest and Northwest, and in the former section heavy rains seriously interfered with the progress of harvesting. This interference was of moment to the grain trade, and resulted in a firmer tone to quotations, in spite of the weakening influence of the very favorable government crop report, which was published June 9. In wholesale lines there are some evidences of fall buying, but purchasers are generally cautious, and sales for immediate shipment are confined to orders filling positive requirements. Uncertainties as to crops and the general disturbance due to the political situation will apparently restrain distant purchases for some time to come. Iron buying is rather better in some grades, and agricultural implement manufacturers have bought more freely of this material and of bars, but the cuts in general steel prices have brought out little new business, the feeling seeming to prevail in many quarters that further concessions are necessary, and that they will probably be made. Building expenditures still run well below a year ago, and lumber and kindred lines are quiet. Collections are still backward as a whole. Money is easy and demand for mercantile paper is in excess of the supply. Gross railway earnings for May are 23.8 per cent below the same month a year ago, the heaviest ratio of decrease shown on the present movement. The movement of commodity prices in May was downward, the decline in the general level being 3 per cent, and the decrease from the high point of last year is 15 per cent. Weekly clearings are 8.3 per cent below last week. Speculation is much quieter, and 13.6 per cent below last year. According to *Bradstreet's*, failures for the week ending June 11 were 253, which compares with 225 the preceding week, 161 in the like week of 1907, 170 in 1906, 175 in 1905, and 181 in 1904. In electrical trades business is reported to be somewhat better in tone, although actual transactions are still limited. Export trade is particularly quiet. Several good orders were reported, and inquiries for small business were more numerous. The General Electric Company reports some improvement, and in one of its important plants it is reported that full time will be resumed instead of the four-day schedule which has prevailed for several months.

THE COPPER MARKET.

The copper market was not distinguished during the last week by any marked improvement. In some quarters there was a hopeful sentiment, and speculative manipulation succeeded in raising prices fractionally higher than at the close of the previous week, but actual purchases of copper showed little improvement, and the relation between supply and demand could not be read otherwise than as tending to lower figures. Domestic consumers bought little metal during the week, and in Europe melters are taking smaller quantities, except when price concessions are made. At times during the week producers' agents in Europe sold copper at several shillings below the standard quotations, which had the effect of increasing the exports from this country. The shipments from Atlantic ports during the week ended June 13 amounted to 7,400 tons, and for June 15 to 1,314 tons, bringing the total shipments for June to 12,183 tons. The production of copper continues liberal in spite of the restricted demand, but is, of course, still materially below that of a year ago. During May there was an increase of about 3,500,000 lb. produced, as compared with April, but the total output was about 8,000,000 lb. below that of May, last year. Figures for the production of the United States, Canada and Mexico, for the first five months of 1908, with comparisons, are as follows:

	1908	1907	1906
January	65,900,000	84,935,143	97,296,400
February	65,036,750	85,278,160	89,205,800
March	79,105,704	102,495,230	96,480,081
April	87,582,805	96,567,700	98,044,400
May	90,880,300	98,500,000	103,800,000
Total	388,505,559	467,776,233	484,826,681

At present the output in Arizona is practically up to the capacity of the properties, the Copper Queen Company being the only large producer in the territory which is not running full time. In California the Mammoth Company smelter is running at capacity, and the British Columbia and Dominion copper smelters in the boundary district have resumed operations, and will add over 1,000,000 lb. per month to the Canadian output. The Butte properties, as indicated by their annual reports to the state tax department on June 1, show enormous decreases, the total net earnings being only $4,648,261, as compared with $20,263,291 in the previous year. The decrease was due to the complete shut down during three months and the operation at only 30 per cent capacity during four months. The net earnings by companies are:

	1908.	1907.
Boston & Montana Company	$1,561,065	$7,049,988
Anaconda	1,132,875	5,819,185
North Butte	1,113,648	3,271,214
Butte Coalition	71,811	1,432,761
Butte & Boston	295,605	1,249,467
Trenton	67,259	481,624
Parrot	.....	141,731
Washoe	246,096	.....
Original	159,902	663,259

Closing quotations on the Metal Exchange, New York, on June 15, were:

Lake	12¾ @ 12⅞
Electrolytic	12½ @ 12¾
Castings	12⅜ @ 12½

The London market was as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	58 7 6	58 5 0
Standard copper, futures	58 17 6	58 15 0
Market	Firm.	Easy.
Sales of spot		450 tons
Sales of futures		800 tons

Extreme fluctuations for the year:

	Highest.	Lowest.
Electrolytic copper, spot	13¾	12¼
Lake copper, spot	13⅞	12⅜
Casting copper, spot	13½	12⅛
London, spot	£64 5 0	£56 10 0
London, futures	64 10 0	56 17 0
London, best selected	67 10 0	60 5 0

BIG ELECTRIFICATION PLANS.—A representative of one of the leading electrical engineering firms of the United States is quoted as follows: "We figure that there is $100,000,000 of electrical equipment for steam roads under consideration in this country, including work planned by the New Haven, New York Central, Pennsylvania, Harriman lines and others. One of the Eastern trunk lines is planning an expenditure of $35,000,000 in electrification. The New Haven Railroad electrification will be extended to New Haven, Conn., and work upon this section will soon be started. Plans are also prepared for electrical installation on the New Haven road between Providence and Boston. The New York Central will likewise extend its system running out of New York, and has plans in embryo for the electrification of the Boston & Albany out of Boston. As between the New York Central and New Haven systems, it is claimed that the New Haven is showing the greatest economies in operation, but the New York Central has $2,500,000 tied up in its Yonkers power plant, which it is not using at present and from which it is getting no returns. Its Port Morris power plant is able to furnish the necessary power requirements. The electrification of steam roads is fast assuming shape, and is unquestionably the next big move in the electrical world."

BEAUTIFYING FACTORY GROUNDS.—As part of its constant effort to beautify the factory grounds at Ampere, N. J., the Crocker-Wheeler Company has moved several large trees and replanted them in different locations on the property. On June 11 an oak tree, 60 ft. high, was lifted by means of the Crocker-Wheeler locomotive crane, carried about 200 ft. and replanted near the new postoffice which is being built on the company's property. The handling of this large tree and the ball of earth in which the roots were embedded involved a nice calculation as to the center of gravity of the tree. The work was accomplished, however, without mishap.

MORE DEMAND FOR HOUSEHOLD APPLIANCES.—A much better demand is reported for electric household appliances. A representative of the General Electric Company, in speaking of this development to a representative of the ELECTRICAL WORLD, said: "We are beginning to realize upon our investment in advertising electric flatirons and other domestic conveniences. The campaign to introduce these lines has been persistent and energetic and, while the growth in popularity of these conveniences has been slow, I believe it will be permanent. People are gradually learning that they can use these appliances inexpensively. We find that where a householder can be induced to try an electric iron she almost always becomes a permanent customer and generally one that will readily begin the use of other similar conveniences. There is a steady growth in demand for these goods and retailers all over the country are beginning to realize that they must be prepared to meet inquiries."

THE HADAWAY ELECTRIC HEATING & ENGINEERING COMPANY, which was some time since acquired by the Westinghouse Electric & Manufacturing Company, has had its office and works removed from 238 West Broadway, New York, to the works of the Westinghouse Company at East Pittsburg. This change will permit the business to be carried on upon a much larger scale than formerly, and all the standard appliances for hatters, confectioners, printers and other manufacturers will be turned out in larger quantities. Special attention is to be given to the manufacture of the sadirons, gluepots and similar appliances that have recently become so popular. A New York office will be maintained on the twenty-second floor of the City Investing Building, 165 Broadway.

RUMORED INSULATED WIRE CONSOLIDATION.—It is reported that the Teter-Heany insulated wire manufacturing business will be absorbed by the Habirshaw Wire Company, of Yonkers, N. Y. It is understood that the controlling financial interest in the latter company is also a large stockholder in the York concern. No confirmation or denial of this report could be obtained at the New York office of the Habirshaw Company.

LARGE ORDER FOR INCANDESCENT LAMPS.—The Central Electric Company, Chicago, Ill., has secured an order for 180,000 Columbia incandescent lamps from the city of Seattle, Wash., shipments being made at the rate of 15,000 per month. This contract is one of the several recently secured, and was handled through the Central Electric Company's Seattle representatives, Mr. Burton R. Stare and Mr. J. A. Savage.

COMMONWEALTH EDISON COMPANY OF CHICAGO.—It is reported that the Commonwealth Edison Company has closed a contract with the Chicago City Railway to furnish power. The contract, it is said, runs 10 years and involves a payment of about $1,200,000 per year. Negotiations for a similar contract are said to be pending between the Commonwealth company and the Chicago Railways Company.

THE F. J. ROONEY LAMP COMPANY, Weehawken, N. J., has equipped a model incandescent lamp factory and is now placing on the market a complete line of standard, miniature, candelabra and ball type lamps. Mr. Rooney's long experience in lamp making augurs well for the success of the product of this company.

STANLEY PLANT OF GENERAL ELECTRIC COMPANY.—The Stanley plant of the General Electric Company at Pittsfield, Mass., is said to have resumed operations on full time in all departments. The plant employs normally about 2200 people, but since the depression in business began some of the departments have been operated on part time.

Financial Intelligence.

THE WEEK IN WALL STREET.

As transactions in stocks have fallen to new low records, and prices have shown a decided tendency to sag, it would be natural to suppose that Wall Street was without speculative developments. Such was not the case. The general cut in steel products, coming after many protestations that prices would be maintained, the unusually encouraging government crop report, and the general acceptance of a settlement, in advance of the conventions of the two presidential nominations, were conditions which in more active times would have caused interest either among buyers or sellers. Each of these conditions might have been taken reasonably, especially by those of sanguine temperament, to presage better times, but no hardening tendency developed. Instead of either the public or speculative interests having the courage to invest, transactions steadily diminished, and the dullest week in the recent history of the Exchange was recorded. Among the more notable losses during the week ended June 13, were Union Pacific, 4⅛; New York, New Haven & Hartford, 3¼; Erie, 4⅛; Illinois Central, 3; Chicago, St. Paul, Minneapolis & Omaha, 4; Cleveland, Cincinnati, Chicago & St. Louis, 3, and Pittsburg, Cincinnati, Chicago & St. Louis preferred, 7. Electric securities were not violent in their changes, but the tendency was generally downward. Allis-Chalmers preferred advanced 3¾ points, Brooklyn Rapid Transit declined 2 points, General Electric declined 3, Mackay Companies advanced 1, and Westinghouse common recorded a loss of 3½. There was little activity in any of the shares. Money conditions continued more favorable to the buying side throughout the week in this country and Europe, and rates were generally easier, with the demand for both call and time accommodations restricted. The export movement of gold dropped to low figures compared with recent engagements, and Paris seems to be the only European center desirous of increasing its stock. On June 15 the conditions which prevailed during the previous week were again in evidence, and the near approach of the convention in Chicago seemed to be sufficient excuse for traders to defer their customary business to some more convenient season. Price changes for the day were mostly fractional. Closing prices for June 15 are quoted in the table:

NEW YORK.

	June 8.	June 15.	Shares Sold.		June 8.	June 15.	Shares Sold.
All.-Ch.	9⅝	10	6,800	Int.-Met., com..	11½	10⅜*	9,200
All.-Ch., pfd....	27⅜	29¼	5,900	Int.-Met., pfd...	32	28½	14,450
Amal. Cop.....	67⅛	67⅞	96,650	Mackay Cos....	66	66*	200
Am. D. T.....	39*	39*	———	Mackay Cos., pfd	65½	64*	400
Am. Loc.....	49¾	48¾	2,500	Met. St. Ry....	30	23*	50
Am. Loc., pfd..	102½	102	550	N.Y.&N.J.Tel.	109	109	60
Am. Tel. & Cbl.	65	65	100	Steel, com.....	37⅝	37¼	150,105
Am. T. & T....	118	118½	3,025	Steel, pfd.....	101½	101⅜	5,935
B. R. T.....	48⅝	47⅛	22,335	W. U. T.....	50¼	—	400
Gen. Elec.....	135½	133¾	1,500	West'h, com....	50¼	44¾	6,710
Hud. R. Tel....	—	—	———	West'h, pfd.....	—	71*	———

PHILADELPHIA.

	June 8.	June 15.	Shares Sold.		June 8.	June 15.	Shares Sold.
Am. Rys.....	44¼	44¼	———	Phila. Elec.....	9½	9½	———
Elec. Co. of Am.	10	10⅛	———	Phila. R. T.....	13⅛	13½	———
Elec. Stor. B'ty.	33	30	———	Phila. Traction..	87	87¼	———
E. S. B'ty, pfd..	—	49*	———				

CHICAGO.

	June 8.	June 15.	Shares Sold.		June 8.	June 15.	Shares Sold.
Chicago City Ry.	165	190	———	Met. Elev., com.	18	17½	———
Com. Edison....	95	97½	———	Met. Elev., pfd.	53	53	———
Chicago Subway.	20	19½*	———	National Carbon.	67	67	———
Chicago Tel. Co.	127	130⅜	———	Nat. Carbon, pfd.	112	112	———

BOSTON.

	June 8.	June 15.	Shares Sold.		June 8.	June 15.	Shares Sold.
Am. Tel & Tel.	117¾	118¼	———	Mass. E. R., pfd.	47	46	———
Comb'ind Tel...	—	—	———	Mex. Tel., pfd..	—	—	———
Edison El. Ill...	211	209	———	New Eng. Tel'p.	110¾	111	———
Gen. Elec.....	135	134½	———	W'st Tel. & Tel.	6	6*	———
Mass. Elec. Ry..	10	9½	———	W. T. & T., pfd.	—	65	———

*Last price quoted.
Shares sold are for week June 8 to June 15.

DIVIDENDS.

Electric Boat Company, New York, quarterly 2 per cent, preferred stock, payable July 3.

Louisville (Ky.) Traction Company, quarterly, 1 per cent, common stock, payable July 1.

Mexican Light & Power Company, Mexico, common stock, 1 per cent, payable June 15.

Westinghouse Air Brake Company, Pittsburg, quarterly, 2½ per cent, payable July 10.

MICHIGAN LAKE SUPERIOR POWER COMPANY.—A complete reorganization of the Michigan Lake Superior Power Company has been recommended by the first-mortgage bondholders committee, which is headed by John Pitcairn. The report proposes the deposit of the $3,500,000 trust mortgage 5 per cent bonds with the Commercial Trust Company, of Philadelphia, and the Guaranty Trust Company, of New York, for the protection of the holders. In addition to the first mortgage bonds, there are outstanding $2,400,000 second mortgage bonds with accumulated interest from January 1, 1903, and $500,000 capital stock. There are also unsecured debts of $1,200,000 and claims of $130,000. It is estimated that it will take $1,775,000 to remedy the defects in the power house and dam at Sault Ste. Marie. At present the plant is shut down to about one-eighth its capacity.

WESTERN UNION COMPANY PAYS CASH DIVIDEND.—Directors of the Western Union Telegraph Company, at their quarterly meeting on June 10, declared a cash dividend of one-half of 1 per cent, placing the stock on a 2 per cent annual basis. The statements for the quarter ended March 31 and partly estimated for the quarter ending June 30 show increases in net earnings over the last quarter of 1907, and the estimated net earnings of the current quarter are slightly in excess of those for the first quarter of 1908. The estimated net earnings for the present quarter are $1,400,000, as compared with $1,330,886 in the preceding quarter and $1,537,201 for the corresponding period of last year. Bond interest was $433,062 and the dividend amounts to $497,550, leaving $469,388 to be added to surplus. This is the first quarter for more than a year showing an increase in surplus, and the gain is, of course, the direct result of the reduction in the dividend rate. The extent of the decrease in net revenue during the year ended June 30, 1908, is indicated by the following comparative statement, the last quarter of 1908 being partly estimated:

Year ended June 30:	1908.	1907.	1906.
Net revenue	$3,223,335	$6,324,210	$7,070,582
Bond interest	1,732,848	1,420,061	1,327,975
Balance	$1,490,487	$4,904,149	$5,742,607
Dividends	4,161,675	4,868,096	4,868,089
Deficit	$2,671,188	*$36,053	*$874,518
Total surplus	$14,213,593	$16,884,781	$16,848,728

*Surplus.

The increase in net earnings in each of the first two quarters of 1908 over the last quarter of 1907 was due to a reduction in operating expenses, not to improvement in business. An official of the company said that the increase in business in recent months had not been sufficient to cause much encouragement. The condition of the company had been improved, he said, by rigid economies in the use of labor and the purchase of supplies. At present, he said, a trifle more activity is apparent, but the business of the company is still far below normal. The economical policy of the company, he declared, was shown in the reduction of dividends to meet the changed conditions.

EDISON COMPANY OF BOSTON.—It is estimated that the earnings of the Boston Edison Company for the year ending June 30 will show an increase of about 5½ per cent in the gross and about 7½ in the net. The estimated earnings of the company for the year just ending compare with the actual figures of the previous year as follows:

	1908.	1907.	1906.	1905.
Gross earnings	$4,241,754	$4,020,620	$3,780,911	$3,346,027
Expens., includ. tax.	2,681,754	2,569,657	2,410,485	2,143,106
Net	$1,560,000	$1,450,963	$1,370,426	$1,202,921
Miscellaneous profits.	40,000	41,340	49,256	33,286
Total net*	$1,600,000	$1,492,302	$1,419,682	$1,236,206
Interest and div'd...	1,325,000	1,406,700	1,227,776	1,164,790
Surplus	$275,000	$85,602	$191,907	$71,415

*Equivalent to a trifle over $12.50 a share on its 126,387 outstanding shares.

The new business secured by the company is comparatively light owing to the general stagnation of business, but the large development of new business during the first six months of the fiscal year will bring the total beyond the largest in the company's history. The recent introduction of the high economy lamp is estimated by the management as already showing the result of customers securing the same amount of candle power from the company for about 7 per cent less money. The incandescent lamps, arc lamps and horse-power connected April 30, 1908, compare with connections on June 30 in the years 1907, 1906 and 1905 as follows:

	April 30,	June 30		
	1908.	1907.	1906.	1905.
Incandescent lamps	939,534	863,313	788,560	708,384
Arc lamps	10,068	10,339	10,534	10,102
Horse-power	38,922	35,096	30,432	26,416

The total connections on April 30 aggregated 1,635,160 cp equivalents, compared with 1,503,478 on June 30, 1907.

GENERAL ELECTRIC-WESTINGHOUSE MERGER RUMOR REVIVED.—The report that the General Electric Company and the Westinghouse Electric & Manufacturing Company are to be merged has made its appearance again in the following statement published in a daily newspaper: "It was said that negotiations for a merger of the Westinghouse and General Electric companies had progressed so far that those who labored to bring about such a consummation were about to take a long vacation, regarding the arrangements as successfully concluded. According to the story current the success of the plan of the merchandise creditors for the adjustment of the affairs of the Westinghouse Company was an essential preliminary to the merger, but it was said there was every reason to believe that no hitch would occur on that account." As on previous occasions when similar reports have been current, the officers of both companies denied the rumor emphatically. "I don't see how such stories arise," an officer of the Westinghouse Company said; "there is absolutely nothing to justify them. It has been pointed out time and again that a merger has not been under consideration and that a consolidation would be highly impractical."

AMERICAN TELEPHONE COMPANY'S EARNINGS.—The report of the American Telephone & Telegraph Company to the New York Stock Exchange for the three months ended March 31, 1908, shows the following: Dividends received, $3,403,567; rental of instruments, $1,348,803; telephone traffic, $2,262,338; real estate, $22,737; interest, $1,285,338; miscellaneous, $8,989; total, $8,331,772. The disbursements were: Expenses of administration, $466,188; interest, $1,928,580; taxes, $60,000; telephone traffic, $1,218,935; dividends (payable April 15, 1908), $3,050,561; total, $6.724,264. The balance was $1,607,508. The balance sheet as of March 31, 1908, showed total assets of $404,771,099, as compared with $359,129,713 on June 30, 1907, and $353,801,015 on Dec. 31. 1906.

HARRIMAN QUITS UTAH LIGHT & RAILWAY COMPANY.—E. H. Harriman has disposed of his interests in the Utah Light & Railway Company, of Salt Lake City, which have been taken over by the Utah Gas & Coke Company. The Utah Light & Railway Company will continue its more important branches, the furnishing of electric light and power and the operating of the local street railway system. The street railway system is being rapidly rehabilitated to a thoroughly up-to-date system. The lines are being reconstructed, and Mr. Harriman recently authorized the immediate construction of shops and barns to cost $350,000.

PUBLIC SERVICE COMMISSION AUTHORIZES MANHATTAN RAILWAY BOND ISSUE.—The Public Service Commission, First District, adopted on June 11 the report of the chairman, William R. Willcox, who recommended that the petition of the Manhattan Railway Company to be allowed to issue bonds in the amounts of $10,818,000 and $894,000, respectively, be approved. Immediately following this authorization the entire block of bonds was sold to the banking house of Redmond & Co., of New York City, and will, by that firm, be offered to the public.

NORFOLK & PORTSMOUTH TRACTION COMPANY.—The report of the Norfolk & Portsmouth Traction Company for the four months ending April 30 shows a slight decline in both gross and net earnings as compared with recent years. The comparisons are:

	1908.	1907	1906.
Four months gross	$558,917	$629,014	$495.379
Expenses	358,650	411,163	321,499
Four months net	$200,267	$217,851	$173,880

ASSOCIATED BELL TELEPHONE OPERATING COMPANIES.—The report of the Associated Bell Telephone Operating Companies for April, not including the American Telephone & Telegraph Company, shows total net earnings of $3,138,500, an increase of $216,400 over April, 1907. The balance for dividends after fixed charges is $2,496,700, an increase of $138,600. The balance available for dividends in the first four months of the year is $9,173,500, an increase over the corresponding period of last year of $779,500.

NEW VICE-PRESIDENT FOR CENTRAL & SOUTH AMERICAN TELEGRAPH COMPANY.—W. Emlin Roosevelt has been elected vice-president of the Central & South American Telegraph Company, not of the Mexican Telegraph Company, as was first reported. Mr. Roosevelt was chosen vice-president to succeed Mr. Charles Lanier, resigned, several months ago, so that no change was actually made when the election was held recently.

PHILADELPHIA RAPID TRANSIT COMPANY.—Consent of the Philadelphia Council has been asked by the Philadelphia Rapid Transit Company to an issue of $5,000,000 new bonds. Not more than half of the new bonds are to be issued at once, and the remainder will be disposed of as the company needs the proceeds. The matter was referred to a committee by the Council.

APPEAL TO WESTINGHOUSE SHAREHOLDERS.—Following the action of the readjustment committee of the Westinghouse Electric & Manufacturing Company, extending to June 22 the time allowed stockholders of the company to subscribe to their portion of the assenting stock, George Westinghouse has issued, under date of June 10, an urgent appeal to shareholders, calling attention to the necessity of prompt action on their part. Mr. Westinghouse encloses a copy of an opinion from the counsel of the company showing what would happen if the merchandise creditors' plan is not accepted. Mr. Westinghouse in his letter says: "About one-half of the shareholders have made their subscriptions, while the merchandise creditors have practically rounded out their obligations to take $4,000,000 of assenting stock in exchange for merchandise debt. In again asking you to respond promptly to the circular of the stockholders' committee, I do so because I know of the substantial character of your enterprise, the strong position in which it will be put by carrying out the merchandise creditors' plan, and because I believe that the shares you now hold, as well as the shares newly subscribed for, will be fully worth their face value. The risks to all stockholders who are unwisely (perhaps unfairly) relying upon the efforts of those who subscribe are altogether out of proportion to any possible benefit of such a course, since no substantial risk is incurred in making the subscription to assenting shares, in view of the fact that the payments are conditioned upon the success of the plan of the merchandise creditors' committee. It is suggested to those who, because of lack of means to pay the first installment, have not subscribed for their proportion, that it will be better to sell a portion of their present holdings, say, an eighth, to meet the first payment of such subscription and to rely on much better terms for selling enough to meet the balance when due, rather than to incur a further risk of losing the entire investment. The opinion by the counsel of the company, sets forth in clear terms the inevitable procedure, should the readjustment committee undertake, under the provisions of the readjustment agreement of Jan. 20 last, to effect a sale of the property in the interest of creditors. No stockholder can read this opinion without a realization of his sense of obligation to himself and to his fellow stockholders." The opinion of the counsel, Cravath, Henderson & de Gersdorff, states in part: "The procedure in winding up a manufacturing company like yours and the transfer of its property to a new corporation would be radically different from the familiar procedure in the case of railroad corporations where, as a rule, reorganization is accomplished by the foreclosure of a mortgage which covers practically all of the property of the railroad company. None of the debt of your company is secured by mortgage, so that there could be no sale of its property in the interest of creditors except pursuant to a decree in a creditors' suit to wind up the corporation, or under judgments obtained by creditors upon their claims. In either case the factories and the tangible personal property at the factories would probably have to be sold at public auction, and there would have to be separate sales of the stocks and bonds and other so-called 'investment assets' which are not appurtenant to the manufacturing plants. The holders of the two issues of collateral notes would be entitled to compel a sale of the collateral pledged as security for their notes and would have a claim rating equally with the claims of other creditors for such part of their notes as remained unpaid after the application of the proceeds of the sale of their collateral. The receivers would be compelled to collect the accounts and bills receivable in so far as they are readily collectible and only the slow and uncollectible accounts and bills receivable would be sold at public auction. There could be no final distribution of the proceeds of the sale of the various assets and of the cash in the hands of the receivers until all the claims against the company had been filed with a special master and had been approved after a final adjudication of such contests respecting claims as might develop. Ending the decision of such contests, there could be partial distributions, the amounts of which would, of course, depend upon the magnitude of the undetermined questions. Experience has shown that winding up a large manufacturing corporation and the transfer of its business and assets to a new company are attended with much litigation and delay, except in the rare cases where there is a substantially complete unity of action on the part of creditors and stockholders. We believe it would take at least a year to consummate a reorganization of the affairs of your company by means of a forced sale of its assets and their transfer to a new corporation. How much longer the process would take, and the extent to which the business and the organization of the company would be demoralized would, of course, depend upon the extent and character of the litigation which would develop." Accompanying these circulars was a statement of the condition of the company on April 30, 1908, as compared with the report of Oct. 23, 1907. It shows that if the stockholders subscribe to the $6,000,000 assenting stock the company will have available cash assets, including accounts and notes receivable, of $20,304,014. The current indebtedness of the company will also be reduced $4,000,000 by the subscriptions of the merchandise creditors already assured. Following the above circulars, George W. Gutherie, of the stockholders' committee, and Joseph W. Marsh, chairman of the merchandise creditors' committee, issued a joint appeal to the stockholders, urging immediate action, and calling attention to the serious danger of the abandonment of the merchandise creditors' plan. This circular declares that the whole rehabilitation plan is "in imminent danger of failing because of the refusal or inability of stockholders to subscribe for the necessary $6,000,000 of new stock." It is stated that only a little more than $3,000,000 of this sum has been subscribed, and that the limit of the time allowed is only a few days away. The circular continues: "The far-reaching and disastrous effect of such failure can be best appreciated by the banking interests, but it will certainly mean the forced liquidation of the company's property, the loss of a large portion of the merchandise creditors' claims, the entire loss of the stockholders' investment, the probable loss of this great industry, and the direct loss of a very large sum of money, in the aggregate, by this community, besides seriously affecting its general business interests. The critical character of the situation is our excuse for presenting these suggestions to you, and we trust that you will co-operate heartily and quickly in the manner outlined, since but one week remains in which to accomplish the desired results." The employees of the Westinghouse plants at Pittsburg have subscribed for 2,000 shares of the new stock in order to help along the merchandise plan, and it is understood they are ready to take 3,000 additional shares. These shares are taken at par, and the amount of money involved is $250,000.

THIRD AVENUE RAILROAD EARNINGS.—The report of the committee representing 4 per cent consolidated mortgage bonds of the Third Avenue Railroad Company, New York, shows gross earnings for the year ended June 30, 1907, of $6,261,162 and operating expenses of $4,399,898. After provision for interest on the first mortgage bonds and bonds of subsidiary companies, taxes, other than the special franchise tax, and interest on floating debt of subsidiary roads, the balance was $1,033,594, which was not sufficient to meet the charges on the $37,560,000 of first consolidated mortgage 4 per cent bonds. The operating expenses did not include an allowance for depreciation.

NEW HAVEN TROLLEY MERGER BILL KILLED.—The House of Representatives of the Massachusetts Legislature has defeated the bill which proposed to authorize the Berkshire Street Railway Company to purchase the stock of the Bennington & North Adams Street Railway. The opponents of the bill asserted that the Berkshire company was controlled by the New York, New Haven & Hartford Railroad and that the passage of the bill would legalize the holding of street railway stock by the railroad and would, therefore, be contrary to recent court rulings.

ALBANY & HUDSON RAILROAD BUYS LIGHTING PLANT.—The Albany & Hudson Railroad, Hudson, N. Y., has purchased the Rider electric plant at Hudson and has taken possession of the entire equipment, including wires and poles, engine, generator and other machinery in the old pumping station. The machinery will probably be sold, but the poles and wires will be retained. When necessary changes have been made, the old line in Warren Street will be taken down, probably during the summer. The Albany & Hudson road spent recently a large sum on its power plant at Stuyvesant Falls. A new engine was installed and the old machinery thoroughly overhauled. Extra trains have been added in preparation of the opening of the season at Electric Park.

PROVIDENCE (R. I.) TELEPHONE COMPANY.—The Providence Telephone Company will ask its stockholders in September for authority to increase the capital of the company from $2,500,000 to $3,000,000. The company has declared a dividend of $1 per share, payable July 1.

GENERAL NEWS

Late items are printed unclassified at end of department

Construction News.

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company has purchased a site in Jonesville, on which it will construct a new power house. The cost of the power plant is estimated at $1,500,000.

RUSSELLVILLE, ALA.—The citizens have voted to issue $24,000 in bonds for the construction of an electric light plant and water works system.

YUMA, ARIZ.—The contract for furnishing the controlling apparatus for the operation of sluice gates in Laguna Dam, Yuma irrigation project, California-Arizona, has been awarded to the Northern Electrical Manufacturing Company, of Madison, Wis., for $4,628.

BAIRD, CAL.—William Ellery, of Redding, has filed on 124,000 cu. inches of water in the McCloud River, near this place, for the purpose of generating electrical power.

BAKERSFIELD, CAL.—The Edison Electric Company, of Los Angeles, is now supplying all the electrical power which it is using in the southern part of the state from its Kern River plant, its other hydro-electric plants being shut down. The reason given is one of economy. Sufficient power can be generated by the Kern plant so long as the present flow of water continues, and it is generated at minimum cost. So far the power plant has not used anywhere near all the water available, and it is now generating 40-000 hp.

GRIDLEY, CAL.—The City Council is considering plans for the construction of an electric lighting system to cost $3,000.

LOS ANGELES, CAL.—The Los Angeles Railway Company contemplates purchasing in the near future two 100-kw motor generators, one 600-kw motor generator and nine transformers.

MARYSVILLE, CAL.—It is reported that the Great Western Power Company is taking preliminary steps toward the installation of a reserve electrical power plant in Yuba County hills. It is proposed to take water from the Yuba River near Goodyear Bar in a ditch for a distance of 25 miles to Pittsburg Hill, where the power house will be located.

MODESTO, CAL.—A complaint filed in the superior court recently for condemnation of right-of-way shows that the Tuolumne Water Power Company, which filed articles of incorporation in this county on April 14, has already begun work on the construction of its tranmission line across Stanislaus County. The company is generating electrical power on the Upper Stanislaus, and will construct a transmission line to a point south of the bay, and from there into San Francisco.

OROVILLE, CAL.—The Great Western Power Company has commenced the work of building a large diverting dam at the intake to its power tunnel. It will be 125 feet high and will turn the river through the tunnel, conveying the water to the electric plant at the lower end.

OROVILE, CAL.—J. W. Goodwin, president of the Oroville Water, Light & Power Company, states that the company contemplates expending about $50,000 on improvements in Oroville. It is further stated that the company contemplates reducing the price of electricity for motors.

RED BLUFF, CAL.—W. J. O'Connor, of Chico, has filed a notice of appropriation of 8000 cu. in. of water to be taken from Deer Creek and carried to the power plant. A second application has been made by J. T. Boyles, of Chico, for 8000 cu. in. of water from the same creek to be used for the same purpose.

SAN FRANCISCO, CAL.—It is reported that the United Railroads is negotiating with the Great Western Power Company to furnish electrical power for operating the street car system, for which between 20,000 and 30,000 kw will be required. It is also said that the Great Western Power Company may make arrangements to supply the Oakland Traction Company and the Key Route system with electricity to operate the Alameda car lines.

STOCKTON, CAL.—The Central California Traction Company has applied for a franchise to operate an electric railway in Stockton.

GOLDEN, COL.—Final surveys are being made for an electric railway from Golden to the top of Mount Lookout. Rees C. Vidler and others are interested in the project.

WESTPORT, CONN.—The Westport Water Company is contemplating increasing the equipment of its electric light plant and extending its transmission lines. F. B. Hubbell is manager.

SMYRNA, DEL.—Plans are being considered for the organization of an independent telephone company to construct two telephone lines from Smyrna to Fleming's Landing and toward Woodland Beach.

WASHINGTON, D. C.—Bids will be received until June 30 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the navy yards and naval stations the following supplies: Mare Island, Cal.: Schedule 1279—Electric traveling crane. Portsmouth, N. H.: Schedule 1294—Two motor-driven, dry-grinder, wood-turning lathes; 12-in. wood-turning speed lathe: mechanical wood-working machine; motor-driven sensitive drills, etc. Applications for proposals should designate the schedule desired by number. E. B. Rogers is paymaster general, U. S. N.

JACKSONVILLE, FLA.—The Board of Trustees on June 3 adopted the recommendation of the electric committee that an electrical engineer be engaged to make an investigation of the municipal electric light plant and water works system to see what is required in the way of improvements and extensions to meet future demands.

ATHENS, GA.—The Athens Electric Railway Company will install another 1000-kw steam turbo-generator unit.

ATLANTA, GA.—Plans are being contemplated by the Georgia Railway & Electric Company to build a three-mile extension of its railway.

MACON, GA.—Orders have been placed for electrical machinery for the large shops of the Central of Georgia Railway Company, which are now under construction.

TROY, IDAHO.—The Inter-State Telephone Company contemplates erecting a telephone line from Troy to Dreary.

CENTRALIA, ILL.—The Centralia Gas & Electric Company has sold its local plant to H. G. Higgins. It is said that improvements will be made to the system.

CHICAGO, ILL.—It is reported that the Chicago City Railway Company has made arrangements to secure all of its electrical energy for operating its system from the Commonwealth Edison Company, at a cost of about $1,000,000 per year. It is expected that the Chicago Railways Company will also purchase electricity from the Commonwealth Edison Company.

CHICAGO, ILL.—The City Council has granted the Sanitary District of Chicago permission to use city poles and conduits wherever possible for the use of the distribution of electricity in the city, and in cases where the Sanitary District wishes to erect its own poles and build conduits permission will have to be granted by the Department of Public Works. R. R. McCormick is president Trustees of the Sanitary District of Chicago.

CHICAGO, ILL.—The Calumet & South Chicago Railway Company, which acquired the Calumet Electric Street Railway and the South Chicago City Railway, has filed a mortgage covering the entire rights and property of the combined companies to secure an issue of $5,000,000 in bonds, the proceeds to be used for rehabilitation work. The First Trust & Savings Bank, of Chicago, is trustee of the mortgage.

KANSAS, ILL.—The Village Trustees have sold the municipal electric light plant to S. J. Blatchford, for $4,000. It is said that the new owner will install new machinery to furnish electricity for street lamps and for commercial purposes.

MARSEILLES, ILL.—The Marseilles Land & Water Company, which has recently completed a transmission line on reinforced poles to Morris and Seneca, expects to build a transmission line west to Ottawa during the coming year.

DANVILLE, IND.—The Danville Light, Heat & Power Company has been granted a franchise to furnish electricity to other towns in Hendricks County.

EVANSVILLE, IND.—The Board of County Commissioners is considering the question of installing electric lighting systems in both the white and colored orphan asylums.

GARRETT, IND.—William Watson, city clerk, writes that the city is contemplating making improvements to the municipal electric lighting plant, the cost of which is estimated at $15,000. R. S. Ashe, of Richmond, Ind., is engineer.

HARTFORD CITY, IND.—The Hartford City Light Company is planning to install new dynamos in its plant.

NOBLESVILLE, IND.—The contract for the construction of the hydro-electric plant on the White River has been awarded to J. C. Dumont, of Detroit, Mich. The output of the plant will be about 800 kw, and will be transmitted to and distributed in Noblesville. H. von Schon, of Detroit, Mich., is chief engineer.

TERRE HAUTE, IND.—Application has been made to the County Commissioners for a franchise to construct an interurban railway from Terre Haute to Linton, via Dugger and Riley, Ind.

ATLANTIC, IA.—Plans are being prepared by J. L. Darnell, Kansas City, Mo., for a power house for the municipal electric light plant.

HARTLEY, IA.—Contracts for the construction of the municipal electric light plant will be let about July 1.

MARSHALLTOWN, IA.—The Marshalltown Telephone Company and the Iowa Telephone Company have been consolidated and it is proposed to enlarge and modernize the system, which will require an outlay of $30,000.

MOUNT VERNON, IA.—It is reported that the power house of the electric light plant and the city pumping station were destroyed by a tornado on June 8.

BARBOURVILLE, KY.—The Camp Ground Telephone Company is making arrangements to erect new telephone lines to Corwin, a distance of 12 miles.

FRANKFORT, KY.—The Capitol Commission has adopted the plans and specifications prepared by Frank M. Andrews, of Cincinnati, Ohio,

for the power house and electric light plant for the new capitol building, for which, it is said, bids for construction will be called at once. The cost of the work is estimated at $75,000.

HAZARD, KY.—The Perry County Telephone Company is planning to extend its lines throughout Perry County.

LANCASTER, KY.—The Bastin Telephone Company will commence at once work on the erection of its lines to Sedalia and Richmond, a distance of about 20 miles. Other extensions are also planned.

MT. STERLING, KY.—Plans are being made by the Kentucky Telephone Company to erect about 50 miles of telephone line to connect Clay City, Stanton and other towns. The company will be in the market for wire and other materials.

NEWPORT, KY.—Bids will be received until July 22 by John W. Davis, city clerk, for a franchise to furnish a telephone and telegraph service in the city of Newport.

PADUCAH, KY.—Contracts have been awarded for the construction of the proposed electric railway of the Ohio River Improvement Railroad Company between Paducah and East Cairo, Ill. The car equipment will be furnished by the General Electric Company. The road will be 38 miles in length. Charles P. Crump, of Columbus, Ohio, is president of the company.

SUTTON, KY.—Plans are being made by the Sutton Telephone Company to erect a telephone line from Sutton to Ash Camp, a distance of 10 miles.

SOUTH PARIS, MAINE.—The electric power station has been put out of commission owing to the high water in the river.

FROSTBURG, MD.—The Frostburg Illuminating & Manufacturing Company has secured a renewal of the contract for furnishing electricity for street lamps.

OAKLAND, MD.—H. P. Tasker, general manager of the Youghiogheny Light & Power Company in a letter addressed to the Mayor and Town Council, states that the company has completed arrangements for financing its project of erecting a hydro-electric plant near Swallow Falls, and asks for a franchise granting it permission to use the streets of the town for a term of 40 years for its proposed electric railway from Swallow Falls to Deer Park.

CHICOPEE, MASS.—The Springfield Street Railway Company has been granted a franchise to construct a street railway in Chicopee.

COLRAIN, MASS.—The Gas and Electric Light Commissioners have authorized the Colrain Electric Light & Power Company to issue $2,500 in capital stock for the purpose of taking over the plant of the partnership now operating under the same name. J. W. Cram is president of the company.

FITCHBURG, MASS.—The joint special committee of the City Council on street lighting contract will recommend acceptance of the Fitchburg Gas & Electric Light Company's offer for a new contract for street lighting at $95 per lamp per year for arc lamps and $20 each per year for incandescent lamps of 30 cp. Under the present contract the city pays $100 and $30 respectively for 324 arc lamps and 93 incandescent lamps.

HANCOCK, MASS.—The Selectmen have granted the Pittsfield Street Railway Company a franchise to construct and operate a street railway in the town of Hancock. The railway will be extended from the present terminus of the West Pittsfield line.

LENOXDALE, MASS.—The citizens are considering the question of installing an electric lighting system. A committee has been appointed to make arrangements with the Lee Electric Light Company to extend its transmission lines to the town to furnish electricity for lamps.

MARION, MASS.—The Marion Gas Company has applied to the Board of Gas and Electric Light Commissioners for an approval of an increase in capital stock of $15,000, the proceeds to be used for improvements to its electric plant.

SPRINGFIELD, MASS.—Permission has been granted to the Springfield Street Railway Company to lay double tracks on Sumner Avenue and Long Hill Street.

STOCKBRIDGE, MASS.—The contract between the town and the Stockbridge Electric Company for lighting the streets of the town has been completed and provides for 85 incandescent lamps of 32 cp, to be installed in Stockbridge, Glendale and Furnace District. Lamps served with overhead wires to cost $15 per lamp per year; and lamps with wires in conduits at $27 each per year. The contract is to run 20 years; the town has the privilege of purchasing the fixtures at the end of that time. The cost of installing the system is estimated between $7,000 and $10,000. It is expected to have the street lighting system ready by July 1.

WELLFLEET, MASS.—The contract for the construction of a dike on Herring River has been awarded to Thomas & Connor, of Middleboro, Mass., for $16,240. The dike will be used for power purposes.

WINCHENDON, MASS.—The Connecticut River Power Company is making surveys around Lake and has located a site for its power house.

CADILLAC, MICH.—The Village Council is contemplating replacing the dam on Cedar Creek, which was recently destroyed, to furnish power to operate the municipal electric light plant.

DETROIT, MICH.—Bids will be received until July 8 by the Public Lighting Commission for installing an electric generating unit in the municipal electric light plant. F. T. Bowler is secretary of the commission.

MONROE, MICH.—The Toledo, Ottawa Beach & Northern Railway Company has applied for a franchise to build an electric railway through the streets of the city. The company proposes to extend the railway from Toledo Beach to Detroit.

MORLEY, MICH.—E. A. Bending and Joseph Bicknell, of Muskegon, are interested in a project to erect a large power plant in Morley. It is proposed to develop power from the Little Muskegon River by a series of dams near Morley and near Howard City.

NEGAUNEE, MICH.—The Marquette County Telephone Company contemplates extending its lines from this city to the Swanzey Range, via Palmer. An exchange will be established at Gwinn.

ALBERT LEA, MINN.—The City Council has directed the Albert Lea Light & Power Company to extend its light and power service.

BRAINERD, MINN.—An election will be held June 23 to vote on the proposition to issue $120,000 in bonds, the proceeds to be used for the construction of an electric light plant and water works system. George Cadogan Morgan, Chicago, Ill., is consulting engineer.

UNIVERSITY, MISS.—Bids will be received until July 1 for the construction of a steam power plant for the University of Mississippi, which will include dynamos, overhead wire, underground conduits, and other machinery. The cost of the plant is estimated at $35,000. D. M. Kimbrough is chairman of the building committee, and F. G. Prout, of Memphis, Tenn., is engineer.

EXCELSIOR SPRINGS, MO.—The Excelsior Springs & Suburban Railway Company is constructing an electric railway from the Chicago, Milwaukee & St. Paul Railroad depot, near Excelsior Springs, to the central portion of the town, a distance of about 2½ miles. The company proposes to install the overhead trolley system, and build a power plant in Excelsior to furnish electricity to operate the system. The company is capitalized at $50,000, and the officers are: W. A. Bell, of Excelsior Springs, president; W. A. J. Bell, of Excelsior Springs, vice-president; J. E. Lundstrom, of Colorado Springs, Col., secretary and treasurer, and W. P. Southard, Excelsior Springs, superintendent and electrical engineer.

KANSAS CITY, MO.—The Kansas City, Ozark & Southern Railway Company is planning to commence construction work on its proposed railway from Ava to Mansfield, a distance of 15 miles. The company also contemplates constructing a hydro-electric plant on Bryant River, 20 miles Southeast of Ava. A. B. Quigley is chief engineer.

MOUNT VERNON, MO.—Bids will be received until June 13, by Dr. J. L. Eaton, president Missouri State Sanatorium for equipment of power plant, electric lighting, heating, etc.

SEDALIA, MO.—The capital stock of the Economy Steam Heating & Electric Company has been increased from $50,000 to $125,000.

BUTTE, MONT.—The electric lighting system was put out of service June 4, caused by the bursting of White's Dam, below the city and the flooding of the power house.

FREMONT, NEB.—The City Council is considering the question of replacing the present street lamps with alternating-current enclosed arc lamps. The Fort Wayne Electric Company, of Fort Wayne, Ind., recently submitted a proposition to the Council offering to make the change for $1,600.

HOOPER, NEB.—Plans are being made by the Hooper Telephone Company to construct new lines west of this city.

PENDER, NEB.—R. P. Mason, village clerk, writes that an election will be held to vote on the proposition to issue $7,000 in bonds to install an electric light plant.

SEWARD, NEB.—Contracts for furnishing material and equipment for the addition to the municipal electric light system have been awarded to Filer & Stowell Company, of Milwaukee, Wis., and the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa. J. Martz is engineer.

RENO, NEV.—Plans are being contemplated by E. J. Baldwin for the construction of an electric railway from the terminal of the Lake Tahoe Railroad & Transportation Company's line to his hotel on Lake Tahoe, and may be extended to circle the lake to include Tallac.

BRIDGETON, N. J.—The Bridgton & Millville Traction Company is contemplating the construction of a spur from its railway near Cedarville to Fortescue.

AUBURN, N. Y.—Plans are being made by the Auburn & Cortland Electric Railroad Company to commence work on the Cortland end of the road in the near future. It is proposed to complete the construction of 36 miles of tracks within two years.

BABYLON, N. Y.—A franchise has been granted to the South Shore Traction Company to construct a street railway on certain streets of the town.

BISMARCK, N. Y.—The Tri-State Telephone Company is planning to erect a telephone line between this city and Napoleon.

BROADALBIN, N. Y.—The Broadalbin Electric Light & Power Company has applied to the Public Service Commission for permission to issue $42,500 in capital stock and $18,000 in bonds; also for authority to construct a dam and generate electricity in Broadalbin under a franchise received from the Town Board.

BUFFALO, N. Y.—The Board of Aldermen has voted to appropriate $5,000, or half of the expense, for an investigation of the prices charged for electricity for lamps and motors in this city before the Public Service Commission. The manufacturers and others using electricity will pay the other half.

DUNKIRK, N. Y.—Plans are being made to begin work on the construction of the new power house at the plant of the Brooks Locomotive Works. When the power house is completed additional machinery will be installed.

LAKE PLACID, N. Y.—The Mountain Home Telephone Company has been granted a franchise at Lake Placid.

MUNNSVILLE, N. Y.—It is stated that an electric light plant will soon be established in this city. W. R. Paul is interested in the enterprise.

NEW YORK, N. Y.—Bids will be received until June 22 by C. B. J. Snyder, superintendent of school buildings for alterations and additions to the electric equipment in Public Schools 2, 22, 23, 28, 88, 92, 105, 131, 140, 161 and 174, Borough of Manhattan. Bids will also be received on the same date for alterations and additions to the electric bell and electric light systems in Public Schools 46, 157, 159, 184, and 186, Borough of Manhattan.

PERRY, N. Y.—Lightning struck the plant of the Perry Electric Company June 9, destroying the dynamo.

WARSAW, N. Y.—It is reported that the Rochester, Scottsville & Caledonia Electric Railway Company has secured all rights of way and franchises required for the road from Rochester to Portage, and that the contract for a considerable part of the construction work will be let in the near future.

NORTH WILKESBORO, N. C.—Work will commence by the Horton Telephone Company on the installation of its system, which will include the erection of about 100 miles of toll lines. Ralph Duncan is engineer of the company.

WILLISTON, N. D.—The city is planning to increase the output of the municipal electric light plant and will install a 150-kw, three-phase, generator, a 200-hp engine and 12 additional arc lamps. C. C. Mackenroth is superintendent.

AKRON, OHIO.—The Big Cuyahoga Light, Heat & Power Company, incorporated recently, is seeking to secure control of the Cuyahoga River from the Portage County line to the confluence of the Big and Little Cuyahoga Rivers by condemnation proceedings in order to secure water power for the operation of electric plants. A large part of the land sought is owned by the Northern Ohio Traction & Light Company and a hard fight will probably result, as the new company will be a direct competitor if it secures the power from the river. This is said to be a revival of a plan conceived by Dr. Eliakim Crosby years ago, when $90,000 was spent in building a dam and a hydraulic canal along the bank of the river.

FREMONT, OHIO.—The hydro-electric development at Fremont, which was deferred last year on account of the financial depression, has been revived. The properties have been taken over by a Columbus, Ohio, syndicate, which has engaged H. von Schon, of Detroit, Mich., consulting engineer, to prepare plans and specifications.

FREMONT, OHIO.—Application has been made by the Fremont Power & Light Company for a franchise to erect lines for the purpose of furnishing electricity for light and power to the citizens of this place. The company proposes to dam the Sandusky River above this city for the purpose of securing water power for the operation of the plant. Chicago, Detroit and Fremont capitalists are interested in the project.

HAMILTON, OHIO.—The City Council has authorized an issue of $64,000 in bonds, of which $25,000 will be used to continue the municipal electric service to the territory recently annexed to Hamilton.

LIMA, OHIO.—Permission has been granted to W. Kesley Schoepf to submit a proposition to furnish rates for electricity for city and commercial lighting to the City Council. The Council has already passed an ordinance and will open bids for a bond issue June 28, the proceeds to be used for the construction of a municipal electric light plant. Mr. Schoepf is seeking a renewal of his 10-year municipal contract.

MARYSVILLE, OHIO.—The Union County Telephone Company intends to make extensive improvements to its system, including the building of lines. R. H. Mathew is manager.

PLYMOUTH, OHIO.—The Board of Public Affairs is considering the question of installing another 75-hp gas engine in the municipal electric light plant. A. T. Ramsey is superintendent.

TOLEDO, OHIO.—Henry A. Everett has been granted a franchise through Ash Township, Mich., on condition that the Toledo, Ottawa Beach & Northern Railway Company, for which the franchise was received, shall construct a spur to Carleton, a distance of three miles.

FAIRVIEW, OKLA.—Arrangements are being made to install an electric light system in Fairview, for which bonds will soon be issued.

STILLWATER, OKLA.—The city of Stillwater will, in the near future, expend $7,000 for improvements to the municipal electric light system.

BAKER CITY, ORE.—The Grande Ronde Electric Company will construct a 33-mile transmission line this summer from Union to connect with the Rock Creek line in Baker County, at a cost of about $50,000. The line will connect with the lines of the Fremont Power Company at the Red Boy mine to the south of Sumpter.

MEDFORD, ORE.—Preliminary arrangements are being made to double the output of the Rogue River Electric Company.

PORTLAND, ORE.—The directors of the Portland Railway, Light & Power Company and the Oregon Electric Railway Company, of Portland, Ore., have authorized the expenditure of $1,199,500 and $300,000, respectively, during the current year for improvements and extensions to the Portland electric traction lines, both city and interurban systems, and the city lighting and power systems. The appropriation will be divided between the different departments of the Portland Railway, Light & Power Company as follows: Portland Railway division, $417,500; Oregon Water Power division, $218,500; Portland General Electric division, $445,000; Salem division, $58,500. The $300,000 authorized by the Oregon Electric Railway Company will be used for improvements to the Portland-Salem railway and for new rolling stock.

STAYTON, ORE.—A. Welch, of Portland, Ore., offers to construct the Salem-Stayton electric railway and give a two-hour service, providing the people along the line of the railway will subscribe for $50,000 in bonds and the people in Salem to another $50,000 in bonds.

TYGH VALLEY, ORE.—The Poe Telephone & Telegraph Company is planning to erect another line between Tygh Valley and Dalles.

CLEARFIELD, PA.—The Cresson & Clearfield Coal & Coke Company is planning to equip one of its mines with electrical machinery. The mine has an output of 1000 tons of coal a day.

HUNTINGDON, PA.—W. M. Hendeson, counsel for the Brookside Electric Railway company, has applied to the Town Council for a franchise to construct an electric railway in the east end of the town to extend up Stone Creek.

HUNTINGDON, PA.—The Brookside Electric Railway Company will apply for a charter to construct and operate an electric railway in the Borough of Huntingdon and the town of Oneida. John M. Laird, F. M. Bollinger, O. C. Breneman, M. A. Miller and Nevin Peightal are interested in the enterprise.

JOHNSTOWN, PA.—Extensive improvements are contemplated by the Johnstown Passenger Railway Company, which will include the construction of the Morrellville extension, renewal of tracks along the Valley Pike in the Eighth Ward, and minor improvements on the Dale line.

McKEANSBURG, PA.—The McKeansburg Rural Telephone Company contemplates the construction of a telephone line to various places. The company is now building a line to Harrisburg.

PHOENIXVILLE, PA.—The Town Council has passed an ordinance permitting the Montgomery & Chester Electric Company to extend its system to the borough line on South Main Street.

PITTSBURG, PA.—The contract for the electrical wiring of the Carnegie Technical Schools has been awarded to the W. H. Ochiltree Company, of this city.

TIDAL, PA.—The Madison Telephone Company will build additional telephone lines to Rimer Hill and Posytown.

LAURENS, S. C.—The Boyd mill power plant, situated on Reedy River, 11 miles west of Laurens, is nearing completion and will soon be put into operation. The plant will have an output of 2000 hp and will furnish electricity in Laurens and throughout the county. N. B. Dise is president of the company.

SPARTANBURG, S. C.—The Spartanburg Railway, Gas & Electric Company is making preliminary surveys for the extension of the street railway line from this city to the fair grounds. F. H. Knox is engineer.

RIPLEY, TENN.—The Nanipoo & Edith Telephone Company is making arrangements to erect a telephone line from this city to Edith. The company recently increased its capital stock from $1,500 to $4,000.

HOUSTON, TEX.—Plans are being made by the Houston Electric Company to commence work on the Harrisburg railway extension. The company is also planning other extensions, which will require an expenditure of about $149,000. David Daly is local manager.

McKINNEY, TEX.—The City Council contemplates issuing $8,000 in bonds, the proceeds to be used for extensions to the electric light plant.

MINERAL WELLS, TEX.—The local electric light plant has been purchased by R. B. Pace, of Shreveport, La.

UVALDE, TEX.—A franchise has been granted to M. M. McFarland, of Austin, to construct and operate an electric railway through the streets of Uvalde.

WHITESBORO, TEX.—John Marshall, mayor, writes that there is an excellent opening for an electric light plant in Whitesboro, which has a population of 2500.

MOAB, UTAH.—Application has been made to the state engineer at Salt Lake City, by Henry Grimm, of Moab, for permission to use the water of Green River to generate electricity for lamps and motors. It is proposed to construct a canal from Green River to Moab.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company is making arrangements to install a new 1500-kw, Allis-Chalmers synchronous motor-generator set with switchboard and other apparatus in the West Temple substation at Salt Lake City.

SWANTON, VT.—The Village Trustees have purchased a new 300-kw Fort Wayne alternating-current generator to be installed in the municipal electric plant located at Highgate, to replace a smaller one at the power house. E. A. Burnett, P. J. Farrell and E. M. Prouty are the trustees.

RICHMOND, VA.—The sub-committee of the Committee on Light has recommended the installation of 103 arc lamps to be placed in the annexed territory. The contract with the Virginia Passenger & Power Company for lighting the streets of the city expires July 1, the city having the option of extending it for one year. A special meeting of the committee will be held soon to consider the matter.

BREMERTON, WASH.—Bids will be received by R. C. Hollyday, chief of Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 8, for constructing a structural steel frame for the central power station, building No. 106, U. S. Navy Yard, Puget Sound.

CHEHALIS, WASH.—The Chehalis Light & Power Company has been incorporated, with a capital stock of $50,000, by C. L. McKenzie and E. Riggs, the present owners of the electric light system. The company is planning to provide for a day service.

EPHRATA, WASH.—The erection of a new telephone line between Ephrata and Soap Lake is contemplated by the Farmers' Mutual Telephone Company.

LITTLE FALLS, WASH.—Work has commenced on the construction of the large power plant of the Washington Water Power Company at Little Falls on the Spokane River, near Reardan. A head of 68 ft. will be secured and 30,000 hp will be developed. When completed this will give the company a total of 61,000 hp at its three hydro-electric plants, besides a steam plant of 20,000 hp reserved for emergency. The cost of the plant is estimated at from $500,000 to $1,000,000.

SEATTLE, WASH.—Charles W. Kimball, secretary and manager of the Seattle, Snohomish & Everett Railway Company, writes that surveys for its proposed electric railway to connect Seattle, Bothwell, Snohomish and Everett have been completed and work on construction, of the road will commence as soon as the route has been established. The overhead trolley system will be installed. The company proposes to secure electrical energy to operate the road from the Seattle Electric Company.

TACOMA, WASH.—The Pacific Traction Company is making surveys for a railway to extend from the terminus of the company's line at American Lake to Olympia. E. J. Felt, of Tacoma, is vice-president.

TACOMA, WASH.—The Current Power Company will make a proposition to the City Council to install a power plant in the Narrows, similar to the one at Strumpfs Rapids, only on a larger scale. Secretary J. H. Boothroyd says that the plant will furnish 10,000 hp and can be installed for $250,000.

TACOMA, WASH.—J. D. Farrell and Samuel Hill are reported to have taken an option on the controlling interest of the power and irrigation project of the Hanford Irrigation & Power Company at Priest Rapids, on the Columbia River, 30 miles northwest of Pasco. By building a canal a mile long parelleling the river 10,000 hp has been developed, and it is said that 20,000 hp more can be developed. It is proposed to organize a company and construct about 100 miles of electric railway. Messrs. Farrell, Hill, Judge Hanford and W. R. Rust, of Tacoma, are interested in the enterprise.

WALLA WALLA, WASH.—The Walla Walla Traction Company has applied for a franchise over the county roads from the south limits of Walla Walla to the north side of Rensom Clark donation claim.

ASHLAND, WIS.—The new management of the Ashland Light, Power & Street Railway Company on June 8 voted to issue $450,000 in bonds, the proceeds to be used to extend the street car lines through the residence portion of the city, to build a new gas plant, to purchase new cars, and to secure a water power and power plant. The line will be extended to Washburn, also to Odanah, and the Copper Falls water power, 18 miles from Ashland, will be developed.

LANCASTER, WIS.—The City Council is considering the question of a new electric lighting contract for the city. The street lighting system consists of 45 arc lamps for which the city pays $50 per lamp per year. Owing to the increase in the cost of fuel and labor the price asked for in the new contract is $65 per lamp. The present service for street lighting is until 12:30 a. m., and from 5 o'clock until daylight during the winter months.

VANCOUVER, B. C., CAN.—F. R. Glover, acting general manager, of the British Columbia Electric Railway Company, writes that the company is planning to build an electric railway from Westminster to Cloverdale, a distance of 12 miles, and next year from Cloverdale to Chilliwack, a distance of 44 miles. Extensions will be made in the city of Vancouver. The company expects to commence the electrification of the Westminster-Eburne road in about a month. Orders have been placed for one 2000 rotary converter for the Vancouver substation; one storage battery of 275 cells, for the Victoria plant; three 500 kw step-down transformers together with extension to switchboards in Vancouver, New Westminster, Burnaby and Lulu Island substations.

PORTAGE LA PRAIRIE, MAN., CAN.—Investigations are being made by Engineer Skinner with a view to improving the lighting system of the city.

HAMILTON, ONT., CAN.—The City Council has decided to submit the offer of the Cataract Power Company and the proposition of the Hydro-Electric Power Commission to the ratepayers for them to choose between the two propositions.

HAMILTON, ONT., CAN.—Engineer Sothman, of the Hydro-Electric Power Commission, announces that it has been definitely decided to build the transmission line along the top of the mountain, and locate the transformer station near Dundas, whether Hamilton enters into the scheme or not. It was originally intended to build the line along the Beach, but it was found it would be much cheaper to put it on top of the mountain.

NIAGARA FALLS, ONT., CAN.—The Ontario Distributing Company has applied to the Lincoln County Council for a franchise to construct a transmission line from St. David's along the Queenstown and Grimsby Stone Road.

OAKVILLE, ONT., CAN.—Sealed tenders will be received until June 23 by A. S. Chisholm, chairman of the Board of Water and Light Commissioners for the construction of water works system and electric light plant, etc. Willis Chapman, Toronto, is chief engineer.

WOLSELEY, SASK., CAN.—The Central Light & Power Company contemplates installing a 150-hp gas engine and a 90-kw generator in its plant. Lee Boyer is manager.

New Industrial Companies.

THE UNION ELECTRICAL MANUFACTURING COMPANY, San Francisco, Cal., has been incorporated, with a capital stock of $50,000, by A. A. Cluc, L. G. Copeman, G. M. Fisk, P. A. Clifford and F. J. McNulty.

THE IDEAL STEAM TURBINE COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000, and the following directors: Francis S. Palmieri, Alfred Bonom and Augustus M. Brown, of New York, N. Y.

THE INDUSTRIAL ENGINEERING COMPANY, of Camden, N. J., has been incorporated, with a capital stock of $10,000, by J. F. McLaughlin, J. English and B. L. Myrtetus. The company proposes to do a general engineering business.

THE STAVE ELECTRICAL COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $100,000. The incorporators are: Theodore Stave, Alexander Watson and Richard H. Smith, of New York, N. Y.

THE EDWARD G. SAWYER COMPANY, of Boston, Mass., has been incorporated with a capital stock of $5,000, by Elisha B. Sawyer, Robert J. Macdonald and Ara E. Barnes. The company proposes to deal in electrical and lighting supplies.

THE VULCAN STORAGE BATTERY COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $25,000. The directors are: Franz Sigel, Charles Lansing, of New York, N. Y., and William Knobloch, of Williamsbridge, N. Y.

THE H. G. TROUT COMPANY, of Buffalo, N. Y., has been incorporated with a capital stock of $60,000, for the purpose of manufacturing machinery, engines, tools, etc. The incorporators are: H. G. Trout, W. B. Trout and H. G. Walker, all of Buffalo, N. Y.

THE GILLETTE SEPARATOR COMPANY, of Phillipsburg, N. J., has been incorporated, with a capital stock of $100,000, by Burroughs C. Gillette, of New York, N. Y.; Martin L. Dreisbach, George C. Mason, Jr., of Easton, Pa., and Clarence Walters, of Phillipsburg, N. J.

THE WILKIRK ELECTRIC COMPANY, of Camden, N. J., has been incorporated by F. R. Hansell, George H. B. Martin and John A. MacPeak, of Camden, N. J. The company is capitalized at $5,000, and proposes to manufacture machinery, engines, motors, dynamos, etc.

THE HARRISON PERCENTER LEVEL COMPANY, of New York, N. Y., has filed articles of incorporation. The company is capitalized at $100,000 and the incorporators are: A. W. Britton, J. D. Baker and B. F. Russell, of New York, N. Y. The company proposes to manufacture mechanical and electrical devices, machinery, etc.

New Incorporations.

MAMMOTH SPRINGS, ARK.—The Mammoth Springs & Memphis Long Distance Telephone Company has been incorporated, with a capital stock of $3,000. The officers of the company are: W. B. Pace, president; E. C. Bellamy, vice-president; L. M. Hynson, secretary and general manager, and C. W. Dixon, treasurer.

CHICAGO, ILL.—Articles of incorporation have been filed for the Northeastern Electric Railway Company. The company is capitalized at $50,000, and proposes to construct an electric railway from Woodbury to DeKalb, Ill. The incorporators are: Clinton G. Lumley, E. C. Spinney, Irving D. Stevens, E. B. Harang, F. H. Rhodes, William L. Abbott, George W. Lyndon and others.

OLNEY, ILL.—Articles of incorporation have been filed for the American Lockout Telephone Company, with a capital stock of $5,000, by Guy E. Terhune, W. B. Huston, Alfred H. Poe and others.

FARMERSBURG, IND.—Articles of incorporation have been filed by the Farmersburg Telephone Company, and the following directors elected: Ameridath J. Aikers, James Brancon, Thomas H. Kendall, Arthur Hook, George Bennett, Harvey Lewis and James H. Forbes. It has an authorized capital stock of $10,000, and proposes to build and equip a new exchange and telephone system in Farmersburg.

MONROE CITY, IND.—The Vincennes & Washington Transit Company has been organized to build an electric railway from Vincennes to Washington via Monroe City, and thence to Bloomington. The interurban railway from Vincennes to Washington, a distance of 21 miles, will be built first. Work is now under way between Monroe City and Wheatland. The road will be built under the direction of Burns & Company, of Chicago, Ill., who will purchase all the supplies and materials and award all contracts.

POSEYVILLE, IND.—The Poseyville Light & Power Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are: Frank W. Seib, August Seib and others.

TERRE HAUTE, IND.—Articles of incorporation have been filed for the Terre Haute & Northern Traction Company, with a capital stock of $100,000, by W. A. Philips, A. J. Stein, D. Russ Woods and S. C. McKeen. The company proposes to construct and operate street railroads in the city of Terre Haute and the towns and villages of Markle, Burnet, Fontenet, Coal Bluff, Perth, Diamond and Bridgeton and to operate an interurban railway connecting Terre Haute with the above new towns. The company also proposes to furnish electricity for heat, lamps and motors.

KEOKUK, IA.—Articles of incorporation have been filed for the Keokuk & Columbus Junction Transit Company with a capital stock of $10,000 to construct an electric railway to connect Keokuk and Columbus Junction and intervening towns. The railway will be about 75 miles in length. The officers of the company are: J. E. Peterson, of New London, president; D. B. Hamill, of Keokuk, vice-president; T. A. Craig, of Keokuk, secretary, and Ira W. Mills, treasurer.

PIERSON, IA.—The Farmers' Mutual Telephone Company has been incorporated, with a capital stock of $50,000, by O. L. Cole, A. C. Fowler, E. J. Raw, O. S. Pixler, F. F. Nicholls and H. DeLambert.

PORTLAND, IA.—The Averydale Telephone Company has been organizer, with a capital stock of $9,990, and proposes to install a telephone system in this city.

SIDNEY, IA.—The Sidney Electric Light, Heat & Power Company has been organized by the purpose of establishing an electric light plant in Sidney. The company is capitalized at $15,000, and Harry Day, of New Madrid, Mo., is manager.

BAVARIA, KAN.—The Citizens' Mutual Telephone Company has been chartered with a capital stock of $10,000.

SHARP, KY.—The Sharp Home Telephone Company has been organized to erect a local telephone system and contemplates extending the system throughout the surrounding country. The company will soon commence work on a line to Little Cypress.

SUTTON, KY.—The Sutton-Hellier Telephone Company has been formed, with a capital stock of $3,000, to erect a telephone line from Sutton to Wright, 15 miles distant, with several short-line branches. John P. Blanton is general manager.

TADELLA, KY.—The Tadella Telephone Company has been formed, with a capital stock of $2,000, to construct a telephone line 12 miles in length connecting Tadella and White Post. J. W. Smith is general manager.

WATERVILLE, MAINE.—Articles of incorporation have been filed for the Vassalborough Electric Light & Power Company with a capital stock of $50,000. The officers of the company are: Edward Chase, president and treasurer, and D. P. Foster, clerk, both of Winslow.

MILFORD, MICH.—Articles of incorporation have been filed for the Milford Home Telephone Company by John N. Weaver, Mark B. Liddell, John C. Black, Charles E. Lovejoy and Milton C. Williams and others. The capital stock of the company is placed at $15,000.

FLOODWOOD, MINN.—The Floodwood Telephone Company has been chartered, with a capital stock of $1,500, by M. A. Schussler, W. A. Baune, C. D. Rutherford, M. L. Freedy and M. W. Johnson.

MARINE MILLS, MINN.—The Scandia & Marine Mutual Telephone Company has been organized. A. Hawkinson is secretary.

ROSEAU, MINN.—The Roseau Telephone Company has been incorporated, with a capital stock of $10,000, by C. A. Peterson, Olaf Holdahl, of Roseau, and others.

PHILADELPHIA, MISS.—Articles of incorporation have been filed for the Philadelphia Electric Company by M. A. Cramer, H. A. Cramer, and A. Cramer.

GREENFIELD, MO.—The Greenfield Electric Light Company has been incorporated with a capital stock of $3,000 by Leroy Lansing, Fred Shafer and E. A. Lansing.

LARUSSELL, MO.—The Spring River Independent Telephone Company has been formed. A. W. Goff, J. T. Burks, L. D. Meador, W. M. Gaff and others are interested in the enterprise.

ST. LOUIS, MO.—The West End Light & Power Company has filed articles of incorporation, with a capital stock of $50,000. The incorporators are: Arthur D. Kloos, J. D. Dana and S. L. Swarts. The company has purchased from Browning, King & Company the latter's electric light franchise rights, granted by the city of St. Louis in 1882, and will erect a plant in the West End soon. Arthur D. Kloos, manager of Browning, King & Company; J. D. Dana, president of the Revere Realty Company, and S. L. Swarts are interested in the company. The new company is planning to erect a plant and generate electricity for lamps and motors. The new concern will be a competitor of the Union Electric & Power Company.

MILES CITY, MONT.—Articles of incorporation have been filed for the Miles City Home Telephone Company, with a capital stock of $60,000, by C. B. Towers and others.

GENEVA, NEB.—The Iowa Central Telephone Company has been organized, with a capital stock of $150,000. The officers of the company are: W. C. Shipley, president, and H. G. Conger, secretary.

STORY, NEB.—Articles of incorporation have been filed for the Story Telephone Company, with a capital stock of $300, by W. B. Donaldson, of Story, and others.

NEWARK, N. J.—The Billings & Eastern Montana Power Company has been chartered, with a capital stock of $1,000,000, to operate street railway and interurban railways, to be operated by electrical or other power. The incorporators are: P. E. Bisland, of Bronxville; C. R. Ganter, of New York City, and F. Randell, of Brooklyn.

CASCADE VALLEY, N. Y.—The Cascade Valley Telephone Company has been incorporated, with a capital stock of $500. The directors are F. O. Taylor, William Bice, Willis Comstock, of Cascade Valley; M. K. Whipple, Thomas Bosket, Charles Ostrander and Edward Seward, of Damascus.

PENN YAN, N. Y.—Articles of incorporation have been filed for the Benton Telephone Company, and the following directors elected: J. K. Turner, William E. Beattie, I. W. Comstock, George L. Turner, Walter Lebbon and Edward Hurrin, all of Gage. The company is capitalized at $1,000.

NORTH WILKESBORO, N. C.—The Horton Telephone Company has been incorporated, with a capital stock of $5,000, by W. W. Horton, J. B. Horton, W. P. Horton and Ralph Duncan.

PISEK, N. D.—The Star Telephone Company has been chartered, with a capital stock of $3,000, by J. F. Spale, of Vesleyville; Frank J. Kouba and Joseph V. Kouba, of Pisek.

BROOKVILLE, OHIO.—The Brookville Electric Company has been incorporated with a capital stock of $20,000 by John W. Brockman, A. Bassert, M. P. Hubbard and others.

CYNTHIANA, OHIO.—Articles of incorporation have been filed for the Hillsboro, Cynthiana & Bainbridge Traction Company by Oliver E. Eylar and others.

KIRKSVILLE, MO.—Articles of incorporation have been filed for the Kirksville Light, Power & Ice Company by Warren Hamilton, C. V. Miller, John C. Mills and others.

MARYSVILLE, OHIO.—The Union County Farmers' Telephone Company has been incorporated, with a capital stock of $24,000, to construct and operate a telephone system in Marysville and Richwood and adjacent territory.

WILLSHIRE, OHIO.—Articles of incorporation have been filed for the Home Telephone Company, with a capital stock of $15,000, by J. E. Snyder, S. L. Evans, A. M. Foreman, S. E. Hurless, W. G. Hoffer and others.

COALGATE, OKLA.—Articles of incorporation have been filed for the Chuka Telephone Company by S. W. Lane, of Coalgate; S. J. Murrow, of Unchuka, and F. P. Reinking, of Wardville, and others.

GUTHRIE, OKLA.—The Pleasant Ridge Rural Telephone Company, of Pleasant Ridge, has been incorporated with a capital stock of $1,500. The directors are: R. P. Knight, D. W. Cunningham and R. C. Barker, all of Frederick.

GUTHRIE, OKLA.—Articles of incorporation have been filed for the Guthrie & Interurban Railway Company by C. R. Renfro, F. E. Houghton, G. Crow, and R. E. Overton, of Guthrie, and E. C. Brown, of St. Louis, Mo. The company is capitalized at $100,000, and proposes to construct an electric interurban railway from Guthrie to a point on the Cimarron River, five miles distant.

GLEN ROCK, PA.—Articles of incorporation have been filed for the Glen Rock Electric Light & Power Company, with a capital stock of $20,000, by C. B. Seitz and others.

MECHANICSBURG, PA.—The Upper Allan Telephone Company has been organized for the purpose of constructing a telephone line between Mechanicsville and Bowmansdale, and will connect with the lines of the American Union Telephone Company.

MILLS, PA.—Articles of incorporation have been filed for the Mills & Ulysses Telephone Company with a capital stock of $5,000, by J. Y. Hoffman and others.

SPRING CITY, PA.—The Locust Grove Telephone Company has been organized by the citizens of East Vincent Township to build a telephone line to connect with the local exchange at Spring City or that of Phœnixville. The officers of the company are: Horace Latshaw, president; Samuel Bertoley, vice-president; Jacob Finkinbinder, secretary, and Amos Kolb, treasurer.

ALAMO, TENN.—The Alamo Home Telephone Company has been chartered, with a capital stock of $5,000, by Charles T. Love, R. L. Conyers, C. A. Foster, T. H. Durham, J. O. Smotherman, H. B. Nance and R. R. Thompson.

NEWMARKET, VA.—Articles of incorporation have been filed for the Newmarket Telephone Company, with a capital stock of $5,000, and the following officers have been elected: J. H. Garber, of Newmarket, president; C. E. Neff, of Quicksburg, secretary and treasurer, and A. M. Neff, of Newmarket, manager.

SEATTLE, WASH.—Articles of incorporation have been filed for the Northern Light, Mining & Development Company by C. T. Sylliaasen, A. H. Dahl and Thomas L. Nyman. The capital stock is placed at $1,000,000.

VANCOUVER, WASH.—The Vancouver Traction Company has been incorporated by E. M. Rands, of Vancouver, W. J. Patterson, of Baker City, and A. Welch, of Portland. This company will take over the property and holdings of the Washington Railway & Power Company formed by W. H. Moore and associates.

MONTREAL, QUE., CAN.—The Saguenay-Quebec Telephone Company has filed articles of incorporation. The company is capitalized at $140,000 and the directors are: J. E. A. Dubuc, J. E. Cloutier, E. G. Gosselin, all of Chicoutimi.

WALLA WALLA, WASH.—Articles of incorporation have been filed for the Walla Walla & Eureka Flat Telephone Company to build a telephone line from Walla Walla to Eureka Junction, and thence through Eureka Flat to Pleasant View. It is estimated that the entire system will cover a distance of about 150 miles.

WASHOUGAL, WASH.—The Sunset View Telephone Company has been organized and the following-named officers elected: Robert Bedell, president; C. C. Buslach, treasurer.

CHIPPEWA FALLS, WIS.—The Bateman Telephone Company has been organized in this city to construct a telephone line from Chippewa Falls to Bateman.

CLYDE, WIS.—The Clyde Telephone Company has been incorporated with a capital stock of $300, by S. J. Gill, Frank Flumery and Dr. Sheldon.

GREEN BAY, WIS.—The Northern Hydro-Electric Company has been incorporated to develop the water power at High Falls and Johnson Falls to be used to generate electricity. B. L. Parker, of Green Bay, is secretary.

Personal.

W. W. COLE.

MR. W. W. COLE, the general manager of the Elmira, N. Y., Water, Light & Railway Company, has taken an interest in the firm of Dodge & Day, of Philadelphia, Pa. He will be in full charge of the operating department for public utilities, and will also look after all expert and consulting work in connection with public service corporations. He will also take charge of financing new engineering projects such as power plants, electric railways and hydroelectric developments. Mr. Cole has long been prominent in the field of electric lighting and traction, and has been in Elmira for many years past, going there nearly two decades ago when he built and put into operation the old West side system. It was under his advice that the public utilities of Elmira were consolidated in the hands of one large holding company and under his management the allied properties are in a prosperous condition. The electric lighting service has been developed, the street railways have been greatly improved, the Seneca Lake line has been bought and rebuilt, and the water system and filter plant are in a high state of perfection. At one time there was considerable prejudice in Elmira against the public utilities, and it is largely due to the work and diplomacy of Mr. Cole that that feeling has been entirely dissipated. Mr. Cole has been active in the affairs of the Empire State Gas & Electric Association, of which he has held the presidency. His resignation at Elmira takes effect July 20, when he will immediately assume his new duties, with headquarters in New York City.

MR. F. G. DANFORTH has been elected president of the Skowhegan Electric Light Company, of Skowhegan, Maine, taking the vacancy caused by the death of Mr. William Doran.

MR. CLEMENT C. SMITH, president of the Columbia Construction Company, of Milwaukee, Wis., has been appointed president of the Eastern Wisconsin Railway & Light Company, of Fond du Lac, Wis.

PROF. FRANK M. DENTON, of the Carnegie Technical Schools, Pittsburg, has sailed for Europe, where he will visit the more important technical schools of Great Britain and the Continent in order to make a study of their methods.

MR. R. T. GUNN, superintendent of transportation of the Fort Wayne & Wabash Valley Traction Company, of Fort Wayne, Ind., has been appointed general manager of the Eastern Wisconsin Railway & Light Company, of Fond du Lac, Wis.

MR. G. F. MAUSBRIDGE, of London, is on a visit to this country. Mr. Mausbridge is the inventor of a new type of electrical condenser, which formed the subject of a paper recently read before the British Institution of Electrical Engineers.

MR. I. W. PHILLIPS, who has been with the North Mountain Power Co., of Eureka, Cal., for the past three years, has resigned his position with that company and, after a short trip East, will take up the development of a water power proposition in Oregon.

MR. DAVID SARSFIELD has severed his connection with the Berwick & Salmon Falls Electric Company, of South Berwick, Maine, and the office of superintendent has been discontinued. Mr. Charles F. Warren and son will have charge of the station and lines.

MR. E. R. WEEKS, of Kansas City, Mo., visited Columbia, Mo., recently and addressed the general assembly of the State University, the teachers' and the women's clubs, on the subject of humane work in Missouri. He also lectured before the university school of engineering on the value of technical education.

MR. N. C. DRAPER, vice-president and general manager of the Eastern Wisconsin Railway & Light Company, of Fond du Lac, Wis., has resigned to become district manager of the Ohio Electric Railway, with headquarters at Zanesville, Ohio. Mr. Draper was formerly with the Westinghouse Electric & Manufacturing Company at Cleveland, Ohio.

DR. ANGUS SINCLAIR.—At the commencement exercises at Purdue University, Mr. Angus Sinclair, editor and publisher of *Railway and Locomotive Engineering*, was made a doctor of engineering, a degree given rarely and only by technological colleges of the first rank. Dr. Sinclair is a native of Scotland, and has long been one of the foremost authorities in the world on locomotive design and practice.

MR. JOHN I. BEGGS has been tendered a vote of thanks by the Milwaukee General Committee on River Front Improvement, in recognition of his unsolicited aid in carrying out one of the objects of the committee, by beautifying the grounds of the Niagara Street power station. A lawn has been laid out between the station and edge of the water, flowers and vines planted, and on all window ledges of the station boxes of flowers and plants have been placed.

MR. R. H. WATSON, formerly of the Gould Storage Battery Company, Chicago office, has purchased the interest of Mr. James R. Deane in the Northwestern Electric Company, of Chicago, and succeeds Mr. Deane as secretary and treasurer of that company. Mr. Deane has become identified with the Guarantee Electric Company in a selling capacity. The Northwestern Electric Company handles mainly second-hand electrical apparatus, in which line of business Mr. Watson has had ample experience, having been for a number of years with the Gregory Electric Company, of Chicago.

MR. W. J. A. LONDON has recently accepted the position of chief engineer of the Terry Steam Turbine Company, Hartford, Conn., succeeding Mr. C. E. Terry, recently deceased. Mr. London's experience in the turbine industry has been extensive, dating from his early connection with the C. A. Parsons Company, Newcastle, England, and about 15 years later with Brown-Boveri Company, Baden, Germany, and the British and American Westinghouse Companies. His work has taken him into the field not only of land turbines, turbo-generators and condensers, but also that of marine propulsion.

MR. EDWARD H. JOHNSON, who went abroad after the development of the Edison lighting and Sprague motor systems, has just returned to this country to stay, after an absence of nearly 10 years, during which his visits have been few and far between. He has spent the interval largely in the development and exploitation of the "regenerative" method of railway motor operation, and has worked out with the aid of other inventors, notable improvements in this direction. He will give his attention to this line of work, but has already been invited to take up several other novelties and systems by those familiar with his many successes and his tireless energy. For the summer Mr. Johnson will make his headquarters while in New York at the Union League Club, but he and Mrs. Johnson have a large amount of visiting to do around the country before they settle down.

Legal.

IN RECEIVER'S HANDS.—J. L. Waddell, of Somerset, Ky., formerly superintendent of the water works, has been appointed receiver of the Somerset Water, Light & Traction Company, of Somerset, Ky., by Judge Jarvis. Application for the appointment of receiver was made by the Louisville Trust Company.

ELECTRIC LIGHT COMPANY ENTITLED TO REASONABLE OPPORTUNITY TO LOCATE DANGEROUS LEAKAGE.—An action was brought against an electric light company to secure damages for the death of a person by coming in contact with a broken telephone wire, hanging down in the street, which in turn was in contact with one of the defendant's electric light wires, the insulation on which had been broken. A line of poles set near the east line of the street where the accident occurred served the double purpose of carrying wires which supported the trolley wire for a street railroad and two telephone wires which were set about 2 ft. apart and about 25 ft. above the sidewalk. During the night preceding the accident a fire had occurred in the top of defendant's pole at the place where the crossarm was attached; the insulation had been burned from the light wires, and the crossarm had been burned in two. This had caused the light wires to drop down to the telephone wires, with the result that one of the latter wires had been burned until it had parted and had fallen to the street, and one of the light wires rested on the other telephone wire, with no insulation between them at the point of contact. The south end of the broken telephone wire remained attached to the pole. A judgment against the company was reversed because it did not appear that the company had had reasonable time to discover and remedy the trouble. In the performance of its duty to exercise the highest degree of care an electric light company is entitled to a reasonable opportunity to ascertain and locate trouble upon its lines and must then be allowed a reasonable time, while exercising greatest diligence, to put its lines in order. Brown v. Consolidated Light, Power & Ice Company, Kansas City Court of Appeals, 109 S. W., 1032.

COLD GALVANIZING LITIGATION.—A decision in equity, on final hearing, has been rendered by Judge Cross, of the Circuit Court of the United States, District of New Jersey, in favor of the Hanson & Van Winkle Company, of Newark, N. J., and Chicago, Ill., and against the United States Electro-Galvanizing Co., of Brooklyn, N. Y., the decision

clearing the electro-galvanizing process of the former from the charge of infringement. By this decision certain salts and processes are authoritatively declared to be free and clear of existing patents which have heretofore been asserted to be all controlling. Electro-galvanizing of certain kinds of work is now specified by the Governments of Great Britain and Germany, and the United States Government has installed at its various ship yards complete equipment for the purpose of treating articles by the electrical method. A large number of manufacturers find this process useful, particularly those who desire to galvanize work of high temper or small cross section which is liable to lose temper or to become warped or distorted owing to the high temperature of the hot bath.

Unclassified Items.

(Items received too late to classify under Construction News, etc.)

SPRINGFIELD, OHIO.—The City Council has directed the lighting committee to investigate the question of erecting a municipal electric light plant and secure data pertaining to the cost of the plant and operation of the same. President C. W. Rich, president of the Board of Public Service, is in favor of erecting the plant, to be erected on the old pumping station grounds.

JOPLIN, MO.—The Joplin Light, Power & Water Company has applied to the City Council for a franchise for a term of 20 years. The Joplin & Eastern Kansas Railway has also petitioned the Council for a franchise to construct its proposed railway in Joplin.

KNOXVILLE, TENN.—The Acme Electric Company, of Knoxville, Tenn., has been awarded the contract for the construction of an electric plant at Montvale Springs.

MANCHESTER, CONN.—The Manchester Electric Company has increased the voltage on its entire system from 3300 to 6600 and is now furnishing a day service throughout.

HARTFORD, CONN.—The Hartford Electric Light Company has increased its capital stock from $2,100,000 to $2,400,000, the proceeds of which will be used for improvements to its plant.

BEAUFORT, S. C.—An election will be held June 29 to vote on the proposition of issuing $43,000 in bonds, the proceeds to be used to buy the present or erect a water works system, to install an electric light plant and to build a new town hall.

MADISON, WIS.—The contract for furnishing two general service pumps and a battery of electric fire pumps for the heating and power plant of the new capitol was awarded June 11 to the Fred M. Prescott Company, of Milwaukee, Wis., for $6,960, by the State Capitol Commission.

HAMILTON, ONT., CAN.—The special sub-committee, having charge of the street lighting matter, has approved of the plans drawn up by Engineer Sothman, of the Hydro-Electric Power Commission. Tenders for a plant with an output sufficient for 625 arc lamps will be received until August 3.

LAFAYETTE, GA.—The supreme court has reversed the election held here some time ago, at which bonds were voted for the establishment of an electric light plant and water works system. It is not probable that an election will be held for some time, as it is doubtful if bonds would be voted at this time.

GUADALAJARA, MEX.—McKeever Brothers, who are operating the El Favor mines, near Guadalajara, Mex., have placed a contract for the construction of a power plant at the dam to furnish power to operate their stamp mill.

WESTERLY, R. I.—At the annual meeting of the Westerly Light & Power Company the following officers were elected: William Clark, president; W. L. Mauran, vice-president; T. E. Steere, secretary and treasurer, and Herbert B. Rust, general manager.

LEICESTER, MASS.—The Selectmen have been authorized to draw up a new contract for lighting the streets. The present contract with the Worcester Electric Light Company expires July 1.

TEKONSHA, MICH.—At a special election held June 9 the citizens voted against the proposition to issue $12,000 in bonds to establish a municipal electric light plant.

LISBON, IA.—The electric light and water plant is reported to have been wrecked on June 8 by a tornado.

GLENS FALLS, N. Y.—Articles of incorporation have been filed for the Mohawk Power Company with a capital stock of $100,000. The company proposes to generate electricity and gas for light, heat and power purposes, and to construct dams across the Mohawk River in the counties of Schenectady, Albany, Saratoga, Montgomery, and Herkimer. The directors are: Eugene L. Ashley, Elmer J. West, of Glens Falls, and Byron E. Morow, of Schenectady.

MAYFIELD, KY.—The electric plant of the Mayfield Water & Light Company was put out of commission again June 11 by lightning. The plant had resumed operation June 9 after having been shut down three weeks following a fire. It will take several weeks to repair the damage, and the whole town at present is without artificial light.

KENNETT, CAL.—The owners of the Gladstone Mine, of French Gulch, are planning to increase the output of the mine, and will install a larger hoisting plant and double the output of the power plant on Crystal Creek.

Business Notes.

ALLIS-CHALMERS BIRMINGHAM OFFICE.—The Allis-Chalmers Company has opened an office at Birmingham, Ala., in charge of Mr. Seldon Jones, as district manager, in rooms 319-320, First National Bank Building.

THE BUFFALO FOUNDRY & MACHINE CO., Buffalo, N. Y., which besides making exceptionally large castings, builds a number of lines of machinery, including pumps and condensers, has recently established a New York office at 143 Liberty Street, in charge of Mr. H. E. Jacoby as resident engineer and manager.

THE CAMPBELL-STAGG COMPANY, 220 Broadway, New York City, representing manufacturers, has been incorporated. The Eastern business of the Steel City Electric Company, of Pittsburg, Pa. (Fullman "Star" bushings and floor outlets), at present handled by William G. Campbell, will be taken care of by the new company. It is the intention of the company to promote the use of floor boxes generally.

I. P. FRINK, of New York City, has equipped all the show windows and showcases in the new store of Messrs. Rogers, Peet & Co., at the northeast corner of Thirty-fourth Street and Broadway, with reflectors. This store is one of the largest and most modern men's apparel shops in the country, and the Frink patent window reflectors serve to illuminate properly the attractive window displays.

MR. JOHN RICHMOND, of the Mechanical Appliance Company, Milwaukee, who was in New York on a business trip last week, stated that his company is at present doing very interesting work in the application of its motors to industrial machines. The variety of these motor-driven appliances is increasing continually, and every line of business is learning the convenience and economy of substituting electricity for hand power in many ways.

INTERLOCKING RUBBER TILING.—Andrew Dall & Son, of Cleveland, Ohio, have recently placed an order with the New York Belting & Packing Company, Ltd., for the installation of interlocking rubber tiling in the Cuyahoga County Court House, Cleveland, Ohio, for which Lehman & Schmit are the architects, amounting to $125,000. This is believed to be the largest order for rubber tiling ever placed. The tiling will be laid in the large court rooms, corridors, judges' chambers, ante-rooms, etc., in different designs.

TRANSFORMERS FOR FOREST PARK, CHICAGO, ILL.—The Central Electric Company, of Chicago, has completed delivery on approximately 2000 kw capacity of transformers for furnishing light and power to the latest pleasure resort of Chicago. The current is taken from the 12,000-volt transmission lines of the Sanitary District, being transformed at 2300 volts and distributed around the park. By means of transformers located in individual tranformer houses, the 2300-volt is again stepped down to 110-220 or 440 volts as desired for operating lamps and motors. The installation of this equipment was completed in a remarkably short time after the contract was placed, this being necessary in order to open the park at the specified time.

ELECTRIC GOODS MFG. COMPANY.—The expansion of the electric specialty business of the Electric Goods Mfg. Company, of Boston, which necessitated the removal last summer of its plant from Boston to its present commodious factory in Canton, Mass., has led to giving up its jobbing electric light supply branch, which has just been sold to the Western Electric Company. The company on June 1 moved its main office to 144 Pearl Street, corner of Purchase, Boston, where it will continue to handle its extensive lines of interior telephones, telephone switchboards, annunciators, gas and acetylene apparatus, Samson batteries, etc., which have made the firm so widely known during a quarter century.

WHITE STAR FILTERS AND OILING SYSTEMS.—The Pittsburg Gage & Supply Company, Pittsburg, Pa., report a decided increase in the sales of its White Star oil filters and continuous oiling systems. A number of oiling systems have been installed in the various plants of the Carnegie Steel Company in the past, and two more installations have just been completed at its Carrie Furnace, Rankin, Pa. The following is a partial list of other sales and recent installations: Republic Iron & Steel Company., Raimond, Ala.; American Iron & Steel Company, Lebanon, Pa.; Shawinigan Water & Power Company, Montreal, Canada; Memphis Cold Storage & Warehouse Company, Memphis, Tenn.; P. & R. Ry. Company, Rutherford, Pa.; Monongahela River Consolidated Coal & Coke Company, Pittsburg, Pa.; New River Collieries Company, Thurmond, W. Va.; Liberty Mills, Nashville, Tenn.; General Fire Extinguisher Company, Warren, Ohio; Austin Biscuit Company, Boston, Mass.

THE CONSOLIDATED SUPPLY COMPANY.—The Consolidated Supply Co., Chicago, which has just been incorporated, will make a specialty in handling general steam and electric railway, mill and mining supplies, with headquarters at 321 Dearborn Street. The office and store occupy the ground floor in the Manhattan Building, the storeroom extending through and fronting on 60 Plymouth Place. The location is ideal, as the office, with a frontage on Dearborn Street as well as the storeroom on Plymouth Place, has large display windows. The incorporators are: L. C. Hopkins, John P. Mahoney and J. L. Benedict. Mr. Hopkins has had some eight years' experience in the railroad and supply business. For the past year he was connected with the sales department of the Chicago Pneumatic Tool Company, and previous to that was four years with Fairbanks, Morse & Company. Mr. Mahoney was formerly chief clerk to the purchasing agent of the T. St. L. & W. Ry. Mr. Benedict was in the railroad business 10 years and for the past five or six years was connected with the Chicago Pneumatic Tool Company, as manager of its Chicago office and on the road.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 9, 1908.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

889,891. METHOD OF PREPARING CARBON ARTICLES; Peter McN. Bennie, Niagara Falls, N. Y. App. filed July 11, 1907. The method of shaping hard carbon articles, which consists in locally softening or graphitizing the parts of the article which it is desired to remove.

889,907. SYSTEM OF ELECTRIC MOTOR CONTROL; William Cooper, Pittsburg, Pa. App. filed Sept. 3, 1907. Comprises a time-limiting device in connection with a device which is dependent upon the current traversing the motor circuits for effecting an automatic acceleration of the motors.

889,908. REGENERATIVE SYSTEM OF CONTROL; William Cooper, Pittsburg, Pa. App. filed Sept. 3, 1907. A system of control for alternating-current railway motors of the commutator type, by which they may be caused to operate as generators and supply a constant current to the distributing circuit regardless of their speed.

889,911. SYSTEM OF DISTRIBUTION FOR DIRECT CURRENT; Frederick Darlington, Pittsburg, Pa. App. filed June 25, 1906. The combination with two or more dynamo-electric machines mechanically coupled together and electrically connected in series relation, of a translating device connected between terminals of one or more of the machines, and means for insulating one or more of the machines from the others and also from the ground.

889,929. ELECTROLYTIC METER; George Hookham and Sydney Holmwood Holden, of Birmingham, Eng. App. filed Nov. 20, 1905. Has a cell provided with a graduated tube of small bore, in which gas produced by electrolysis is measured at a pressure independent of barometric pressure.

889,931. ELECTRICAL TRANSFORMER; Svend E. Johannesen, Pittsburg, Pa. App. filed March 3, 1906. An arrangement of circuits and parts of an auto-transformer employed in voltage regulation and so adjusted that the variations in the reactance therewith with variations in the voltage adjustments may be confined within very narrow limits.

889,937. ELECTRODE FOR ARC LAMPS; George M. Little, Pittsburg, Pa. App. filed May 10, 1906. An arc lamp electrode comprising a plurality of layers composed alternately of iron and copper.

889,956. INSULATOR; John P. Nikonow, Pittsburg, Pa. App. filed May 11, 1906. The insulator has a conical central pin which depends from a conical sleeve within a housing which is designed to be perfectly watertight, so that leakage currents cannot pass through the interior of the ribbed porcelain body.

889,963. MERCURY SWITCH FOR RAILWAYS AND THE LIKE; Robert Pfeil, of Grunewald, near Berlin, Germany. App. filed Jan. 6, 1908. A means for enabling a traveling train to act on fixed working devices. Makes use of switch elements wholly enclosed in a casing having a mercury bath.

889,989. TRANSFORMER REGULATOR; Wilbur H. Thompson, Wilkinsburg, Pa. App. filed June 25, 1906. In a regulating transformer the combination with a stationary hollow cylinder and magnetizable core, of a plurality of symmetrically disposed coils which are mounted to revolve around the axis of the core and each of which surrounds the core wall.

890,001. ELECTRIC SAFETY AND ALARM SYSTEM FOR RAILROADS; Herbert D. Williams and Marcus Leonard, Vermillion, Kan. App. filed April 18, 1907. Railroad signal system making use of spaced contact rails connected with semaphore signals and designed to establish alarm signals on the trains through depending contact shoes.

890,030. ELECTRIC RAILWAY BOND; John Dolan, Dayton, Ohio. App. filed June 15, 1906. Form of rail bond, making use of laminated ribbons with soldered ends, having rivets and surfaces adapted to be soldered to the rail.

890,042. AUTOMATIC TELEGRAPHIC TRANSMISSION INSTRUMENT; John Gell, of London, England. App. filed Aug. 12, 1907. Automatic telegraph transmitter of the type adapted to send dots or dashes continuously by alternate movements of the operating key. Relates to details of the T-shaped operating lever, having specially constructed contacts.

890,049. ELECTRIC SIGNAL FOR RAILWAYS; Joseph H. Gunn, Cortland, N. Y. App. filed Oct. 31, 1907. A railway signal system particularly adapted for trolley roads. The patentee makes use of specially constructed semaphores which depend directly in the path of the train so as to insure their observance.

890,053. ELECTRICAL INSTANTANEOUS WATER HEATER; Louis C. Henriksen, Los Angeles, Cal. App. filed April 10, 1907. Comprises a casing having a plurality of coils to carry the water and an electrical conductor, comprising resistance elements arranged in juxtaposition to the water-carrying coils.

890,058. TROLLEY; Samuel D. Hunt, Youngstown, Ohio. App. filed Oct. 9, 1907. A trolley system having a main feed wire and auxiliary side wires. The harp carries special trolley wheels to engage all the trolley wires so as to maintain an effective contact at viaducts and the like.

890,084. PROCESS FOR THE PRODUCTION OF ALUMINUM OXID; Frank W. Morris, Victoria, British Columbia, Canada. App. filed March 13, 1907. A means for producing aluminum oxid from any clay by electrolytic action.

890,094. RAILWAY SIGNAL APPARATUS; Charles A. Pitts, Callahan, Cal. App. filed Aug. 19, 1907. Has a trip alongside of the rail and designed to be operated by a projecting tappet on the locomotive. The trip has mechanical and electrical connections for operating signals.

890,125. CABLE CLIP; Stewart H. Crampton, New York, N. Y. App. filed Oct. 30, 1907. A strap for suspending a cable from a messenger in making use of sheet metal stamping with one notched end, which co-operates with a perforation in the other end.

890,144. AUTOMATICALLY CONTROLLING ELECTRIC MOTORS; Harry W. Leonard, Bronxville, N. Y. App. filed Jan. 5, 1903. The combination with a main source of electric energy, a motor to be controlled, a dynamo electric machine supplying energy to said motor, a second motor operated by energy from the main source for driving said dynamo, and means controlled by the amount of energy taken by said second motor from the main source for changing the resistance in one element of said dynamo electric machine.

890,183. MAGNETIC CIRCUIT BREAKER; Ralph Scott, New Brunswick, N. J. App. filed Jan. 17, 1906. A magnetic circuit breaker of such form as to be capable of use on a panel board in place of the usual enclosed fuses. The patentee has a structure which secures a separation of the circuit-breaking contacts with great suddenness and under circumstances which produce a magnetic blow-out of the arc and the formation of gases to destroy the same.

890,198. ELECTRIC RAILWAY; Louis H. Thullen, of Edgewood, Pa. App. filed March 2, 1906. Means for indicating to a motorman whether or not there is sufficient potential in the sectional conductor which he is approaching to operate his car or train, or whether it is excessive.

890,200. ELECTRIC CUT-OUT; William C. Tregoning, Cleveland, Ohio. App. filed April 8, 1907. Electric cut-out of the type having two blocks with under-cut metallic ledges, which can be engaged by a bayonet joint movement, making an electrical and mechanical connection.

890,201. TROLLEY REPLACER; John Trout, Philadelphia, Pa. App. filed July 11, 1907. The patentee has flaring arms pivoted outside the trolley harp, which are raised to guide the wheel on the wire by a tension on the operating cord.

890,220. ELECTROMAGNETIC SIGNAL CONTROLLING DEVICE; Henry M. Crane, New York, N. Y. App. filed Jan. 29, 1906. An electromagnetic signal controlling device adapted to effect the sequential operation of electrical devices, especially in connection with telephone exchange service for use as a combined line and cut-off relay.

890,249. PROCESS OF OBTAINING PURE TIN FROM CRUDE TIN OR TIN ALLOYS ELECTROLYTICALLY; Otto Steiner, Crefeld, Germany. App. filed Aug. 10, 1907. The method of obtaining pure tin, which consists in electrolytically dissolving crude tin in a solution of an alkali sulfid and simultaneously plating out the tin upon a cathode of pure tin and maintaining an electrical tension of less than 0.2 volt between the electrodes.

890,255. INCLOSED FUSE; Frederick H. Weston, Jr., and Frank C. De Reamer, Schenectady, N. Y. App. filed Dec. 6, 1904. The patentee has a pair of flat fuse strips of reduced section at their middle portions and enclosed in a tube containing insulating refractory substance.

890,285. CONDUIT COVER; Hubert Krantz, New York, N. Y. App. filed Oct. 18, 1907. A form of staple or latch for the interior surfaces of conduit box covers, having lugs for guiding the action of the device and all formed of integral sheet metal.

890,299. AUTOMATIC REGULATION FOR DYNAMO ELECTRIC MACHINES; Ferdinand Porsche, Vienna, Austria-Hungary. App. filed April 4, 1903. A dynamo electric machine for motor vehicles, designed to furnish current for driving the machine. The dynamo is specially constructed and arranged on the usual transmission shaft.

890,349. ALARM SIGNAL MECHANISM; Ellsworth E. Flora and Robert J. Zorge, Chicago, Ill. App. filed June 19, 1907. A means for placing torpedoes on track rails in advance of a train, under the influence of signal mechanism.

890,367. RAIL BOND; George A. Mead and Charles R. Sturdevant, Mansfield, Ohio. App. filed Nov. 25, 1904. The rail bond has a terminal provided with a raised rib extending adjacent the ends thereof and along the lower edge to form a recess or seat which, when the terminal is applied to the surface of a rail or other part to be bonded, is closed along the lower edge thereof and open along the upper edge thereof to receive solder.

890,374. CABLE SWITCH; Edward H. Pryor, Medina, N. Y. App. filed July 16, 1907. A form of cable switch having a pair of arms converging in one direction, one of said arms being adapted to lie against and engage a supporting cable and the other being adapted for the attachment of a guiding cable and presenting an inclined and laterally extending guide to direct the supporting hooks of a conducting cable from the guiding cable on to the supporting cable.

890,421. TROLLEY WHEEL SUPPORT; John H. Gross, of Norwalk, Ohio. App. filed Oct. 10, 1906. In place of the usual pole, the patentee has a system of parallel rods, which maintains the usual harp and wheel in a predetermined angular relation to the wire under all circumstances.

890,451. GENERATOR OF ELECTRIC OSCILLATIONS; Valdemar Poulsen, Copenhagen, Denmark. App. filed Feb. 1, 1908. In an apparatus for generating electric oscillations by means of an electric arc or the like, a circuit, including inductance and capacity; an electrode in said circuit, an electrode having a thin coating forming the actual electrode substance and means for continuously renewing said coating.

890,453. APPARATUS FOR ALIGNING CONDUIT SECTIONS; Joseph T. Rice and Coleman King, West Hoboken, N. J. App. filed Feb. 23, 1907. An expansible plug designed to be pushed into a conduit between the sections to be aligned and expanded by wedge action while the sections are being soldered together.

890,458. SYSTEM OF MOTOR CONTROL; George B. Schley, Norwood, Ohio. App. filed March 29, 1907. A system of train control in which only a single train wire is used. Has main controllers on the different cars, which are caused to move into any operative position for either forward or backward movement by operating any one of a number of master controllers throughout the train.

890,496. PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS; Herbert W. Cheney, Norwood, Ohio. App. filed April 29, 1907. Provides a protective device in conjunction with a starting controller which shall properly protect a motor or other translating device at both starting and during normal operation, while also allowing the heavy current necessary for starting.

890,539. FIELD COIL SUPPORT; Emmett W. Stull, Norwood, Ohio. App. filed March 9, 1905. A coil support, consisting of a plate of spring metal having a central opening to receive a pole piece, said plate having tabs punched therefrom; said tabs being bent out of the plane of said plate alternately in opposite directions.

890,577. VENTILATED LAMINATED CORE FOR DYNAMO-ELECTRIC MACHINES; Walter J. Richards, Norwood, Ohio. App. filed Oct. 31, 1906. A core for dynamo electric machines, comprising a plurality of main laminæ and groups of special laminæ arranged at intervals, forming ventilating passageways, the special laminæ having overlapping openings adjacent, respectively, the outer and inner peripheries of the core.

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DISCRETION IN BUSINESS BUILDING.

At the National Electric Light convention last May a number of speakers dwelt on the importance of using some common sense in soliciting different classes of central-station business and putting the greatest effort on those which bring the greatest net returns. In the past three years of great activity in the building up of central-station load and the training of new soliciting forces, there has sometimes been too much emphasis placed on the gross amount of load connected without regard to how profitable it is, and how much investment is required to take care of it. The investment charges are such a large percentage of a central-station's cost to serve that it is important to concentrate effort on such kinds of business as yield a high gross revenue per dollar invested as that also means a high net revenue. It is especially desirable at times when financial conditions prevent expenditures in extensions, that effort be devoted to securing more income from existing lines and from existing customers.

Simply to increase a central-station company's connected load without in any way changing the character of that load may result in an increase in net earnings where a plant has been previously underloaded, and where the increase in load has meant nothing but an increase in fuel expense. An increase in the company's load without any change in the character of the load curve and without increasing the average with reference to the peak load means in the long run simply an increase of investment with no decided change in earning capacity. Of course, as a company grows it usually installs more economical machinery and in general has more economical methods of doing business, which tend to increase the net revenue per dollar invested. On the other hand, the larger the company the more expensive is the distributing system and the larger the investment per kilowatt of equipment. As a general proposition, therefore, it may be safely stated that if a plant wishes to make a steady improvement in its net earnings, it must also make a steady improvement in its load factor; that is, in the ratio of the average to the maximum load for the year. Although there is no business taken by a central station company which does not call for some increase of investment, yet there is a great difference in the amount of increase called for by different classes. At the same time, there should not be too much conservatism about taking on business which calls for increased investment; otherwise a central station's territory would not be properly developed and competition would be invited; but once an investment has been made in an extension or in any part of the central-station system, the manager should not rest until business has been built up to utilize that investment to the fullest extent. This usually means that a greater amount of effort than formerly should be devoted to the building up of business which is on at other times than simply during the period of the maximum peak load.

Central Stations and Contractors.

Electric light convention discussions recently have brought out the fact that we are now entering on a new era of co-operation between central-station companies and electrical contractors. That there has not been enough co-operation between these parties in the past is evident to anyone who has been familiar with general conditions. For this lack of co-operation both central stations and contractors are to blame. Two or three years ago, when central-station companies began to awake generally to the necessity of more active efforts to take on additional business, one could hear it frequently said by the central-station man that the electrical contractor had not sufficiently pushed business or that his work was not satisfactory, and for these and other reasons the central-station company was taking this business into its own hands. There are many places where central-station companies are contracting for wiring and keeping supplies mainly because there is no satisfactory independent concern doing that kind of business in the town. If the central-station company has the right to complain that the contractor has not been as active in getting after new business, or as faithful in properly fulfilling his contracts as he should have been, the contractor, on the other hand, frequently has to urge against the central station that it has not given the attention which it should to the business brought in by the contractor.

The fact is, as long as central stations and contractors fail to pull together, just so long will the business lack the rapid development which it should have. The central station should encourage and help the contractor in every way possible. There have been times when central-station companies have thought it advisable to sell electric irons and some other devices at about cost, thus shutting the contractor out of this class of business. It is entirely true that if left to the contractors alone, much of this business would never have been developed. The contractor and dealer cannot afford to spend as much money on such sales as the central station. Nevertheless, the contractor adds another business-getting factor in a town, and if his efforts are properly encouraged by the central station, he can do the company a world of good, besides relieving it of considerable detail work. We have in mind one small town where the central-station company and contractor are planning a campaign together for the introduction of different devices, and are working as harmoniously as if they belonged to one organization. The company has even gone so far as to help the contractor financially by taking the commercial responsibility for large orders of different devices which the contractor would not dare assume alone. This the company is in a position to do because it has a fully mapped-out policy that calls for the introduction of a certain number of appliances in a certain time, but it will take no active part in their introduction if the contractor demonstrates his ability to place them along with his other work. In the case of winning over gas customers to tungsten lamps and installations of that kind, it is the understanding that the contractor shall exert his best endeavors to put in a tungsten lamp installation before the company takes a hand in the game. It is true that the contractor makes a certain amount of profit on these things which the company, with an equal amount of effort, might otherwise make; but given an energetic contractor and a company which has its hands full of other matters, the chances are that the company would not, after all, make much, and that the central station business will grow faster by virtue of having a live contractor looking after one end of it than if the company were handling the whole thing. Of course, conditions vary in different towns. The conditions just described do not exist in every town. Nevertheless, there is a decided movement among both large and small companies toward better co-operation between the contractor and central station. The dinner given to the contractors by the central station at Brooklyn recently, in which the plans of the company were explained and the co-operation of the contractors enlisted, is an illustration of this.

The Faulting of Tantalum Lamps.

We present on page 1374 some interesting pictures reproduced from microscopic observations of tantalum filaments taken from incandescent lamps at different stages of service with different types of current supply. It is well known that tantalum filaments last much longer on direct-current circuits than on alternating-current circuits, and a tantalum filament that commences by looking like a polished walking stick under the microscope, soon becomes rocky on alternating-current supply, and resembles a basaltic column badly broken up, like the pillars of Fingal's cavern. The pictures presented show the effect very well, but no one has yet suggested any theory of the action. It would be very interesting to know whether the result is purely thermal, due to rhythmic heating, or whether it is electrical in some degree.

Uniform Illumination.

An article by Mr. Alfred A. Wohlauer on page 1376 of this issue gives some convenient constants for use in determining the proper number and distribution of certain lighting units to obtain a desired illumination effect. The author demonstrates by well-known photometric relations that the number of lamps required varies directly with the product of the area to be illuminated with the strength of the illumination desired, and inversely with the effective lighting power of each lamp, and is independent of the height of suspension. The equation used for expressing this relation contains a certain factor a, the value of which depends upon the lighting units employed. The exact conclusions of the author are based on the use of lamps equipped with certain types of reflectors in order to obtain uniformity of illumination. The table giving values of the factor a should prove serviceable in the solution of practical problems in illuminating engineering.

It is interesting to note that the actual value of the factor a for any chosen lighting unit affords an excellent indication of the efficacy of the reflector in turning the light rays from the lamp into the desired direction. The values reported by Mr. Wolhauer are evidently those obtained from photometric observations of the rays sent immediately from the lamp or reflector in the desired directions. Thus the light which may reach the illuminated plane by reflection from the ceiling has been neglected, and the values represent results that would be obtained with black ceiling and side walls. Tests of actual installation of lamps equipped with reflectors that absorb very little light would show that the effective illumination of a room with white walls and ceiling depends more upon the total candle-power of the lamps than upon the exact shape of the light-distribution curve of each lamp and its reflector. It would seem, therefore, that with the factor a there should be used an additional factor whose value depends upon the light reflected from the ceiling.

WHAT IS LIGHT?

This question has been asked in a great variety of different meanings, and has likewise been answered, at least in attempt, in an equally great variety of significances. The naïve reply of the schoolboy to this question, in an elementary examination on physics, ought not to be omitted. It ran thus: "Light, as I understand it, is very little understood." The particular inquiry which we contemplate on this occasion, however, is directed to a scientifically accurate yet practically manageable definition of that commodity which is produced, either naturally by the heavenly bodies, or artificially by lamps, in order to enable us to use our eyes. The definition is specifically directed to the relation between this commodity and the radiant energy upon which it depends. Light is obtained from radiant energy; that is, electromagnetic-wave energy of certain kinds. The wave energy must be rhythmically sustained, like a steady organ tone, as distinguished from a random succession of noisy and irregular impulses. The wave energy must also reach the retina within certain limits of vibration-frequency, or of wave-length. In other words, it must lie within the visible spectrum. Suppose that we know the amount of such electromagnetic power falling on the eye, and also the relative distribution of this power with respect to frequency or wave length. Will the sensation of light corresponding thereto be proportional to this power, or how will it vary with the amount, or with the spectrum distribution?

These are very important questions from the scientific side, full of interest to the physicist, the biologist, the physiologist, the oculist and the optician. They are also very important questions from the practical side, to the above named specialists, as well as to the illuminating engineer, the lamp manufacturer, the electrical engineer and the central-station manager. All of these are virtually interested in the production, utilization and sale of the commodity light. How to give satisfactory physiological light-sensation from electric energy in kilowatt-hours, is a problem that is of the greatest commercial importance, however complex and many-sided it may be. The problem is so large that the central station confines itself ordinarily to the generation of electric energy, except in contracts for street lighting. The illuminating engineer shoulders the next stage of the task, in undertaking to provide adequate and æsthetic illumination, measured in foot-candles, or meter-candles, with due regard to economy, from electric power. These specifications are sufficient for the existing industrial conditions. But the specific problem of supplying adequate and pleasing luminous sensation has had to be deferred because we do not yet grasp it properly, or understand its relations.

The article by Mr. P. G. Nutting, on page 1371 of this number, is addressed to a preliminary outline of these conditions which define light sensation in terms of radiation-power. It is shown that three factors are involved, namely, first the relative distribution of the power in the visible spectrum; second, a sensibility-factor of the eye which must be applied to the incident power, in order to arrive at the total retinal stimulus; and third, a sensation-factor which must be applied to the above product in order to determine the total luminous sensation which the stimulus produces. Both the sensibility-factor and the sensation-factor may vary among different individuals—notably, in color-blind persons. Taking average values, however, to represent average individuals, the sensibility-factor will vary with the spectrum distribution, while the sensation-factor will vary with the stimulus. If we double the visual stimulus on the retina, we do not double the visual sensation. According to the views given in the article, which are generally accepted, we have two kinds of instruments in our retina for perceiving light. These are respectively the rods, and the cones, which lie distributed over the retinal surface in great numbers, each being said to have an independent nervelet connection in the great optic nerve connecting the retina with the brain. The rods appear to be mainly distributed over outlying areas of the retina, and are supposed not to be capable of conveying color sensation. The cones are most numerously distributed in and near to the yellow-spot, the center of visual perception, and are supposed to be differentiated with respect to color impressions. It would seem that the rods are vestiges of the visual implements used by our remote ancestors in the order of evolution; while the cones are of more recent development. This idea receives support from the fact that the rods are relied upon for very feeble visual sensations, or illuminations on the eye of 0.1 foot-candle or less—that is, in illumination too feeble to read by; whereas, for illuminations above this value, and particularly above 1 foot-candle, the cones become actively engaged. This accounts for the fact that colors disappear at dusk. A Whistlerian night-picture gives us hardly any suggestion of color values; we see only muddy murkiness of varying depths. In such feeble lights, the cones are sound asleep. In dull light we do not spare the rod but spare the cones.

It is a very remarkable fact, as pointed out in the article, that in very feeble light, i. e., rod-light, the sensitiveness of the eye is a maximum at a color that seems to vary slightly among different individuals but averages 0.51 μ, or a little over half a micron. This is in the green, and toward the blue side thereof. On each side of this green color the sensitiveness of the eye diminishes according to a curve that resembles the probability curve. Perhaps it should be a probability curve, because we are dealing with the behavior of a very great number of different rods of the same general type. It is interesting to remember that water, and especially sea-water, is much more transparent to green and blue light than to yellow and red light, so that fishes, a few meters below the surface, have to get along with vestiges of greenish blue light. Possibly we owe our retinal rods to fishy ancestors who developed them in many generations of feeble greenish-blue light. When we bring our retinal cones into action, however, that is, when we work in regular daylight values of illumination, amounting to several or many foot-candles, the article shows that the maximum sensibility of the retina is no longer at 0.51μ, but at nearly 0.57μ, or in the yellow. It has been shown, in fact, that the maximum sensitiveness of the cone-using eye corresponds in spectrum position, at least approximately, with the maximum power of sunlight. Possibly then rod perception is adjusted, by long-distance inheritance, to the best daylight illumination under the surface of the sea; while certainly cone perception is adjusted to the best daylight illumination above that surface. The Purkinje effect is the result of this variation of retinal sensibility to different colors as we reduce from strong to very weak illuminations.

Chicago Railway Power Contract.

The Commonwealth Edison Company, in Chicago, is closing up the details of a contract with the Chicago City Railway Company which is practically an extension of the arrangement already in force, whereby most of the power for the Chicago City Railway system is supplied by the Commonwealth Edison Company, as extensively commented upon in our article in the May 16 issue on the Commonwealth Edison system. Besides this, negotiations are under way with the Chicago Railways Company operating the surface lines on the north and west sides for an extension and enlargement of its contracts. Both surface and elevated railroad lines of Chicago, with the exception of the South Side Elevated Railroad, have depended mainly on the Commonwealth Edison Company for power to take care of all the increase of business for a number of years past.

Educational Plans of Boston Edison Company

The Edison Illuminating Company, of Boston, has completed arrangements with Prof. Sydney Whitmore Ashe to carry on next winter a comprehensive scheme of educational work for its employees. The course, which will be given beginning Jan. 1, will be along lines somewhat similar to the educational courses carried on in the past two years by the New York Edison Company and the Brooklyn Edison Company. The number of lectures to be given will be limited to 20, sessions being held both afternoon and evening, thus affording all employees an equal opportunity to attend. The course will be given directly under the supervision of the Edison Club, a special lecture committee being appointed for the purpose. Mr. Herbert W. Moses, president of the club, will be chairman of the committee. The lectures will be one and one-half hours in length, and will be both theoretical and practical, everything being demonstrated in an experimental manner.

Process for Making Incandescent Lamp Filaments.

A patent issued June 16 to Werner von Bolton, of Berlin, Germany, describes a process for making tantalum-lamp filaments. The application, dated Feb. 4, 1906, is a division of an application filed Dec. 28, 1905.

As tantalum metal exists in the form of an amorphous powder, to obtain a coherent metallic mass, the powder may be mixed with a binder, such as paraffin, or preferably subjected to high pressure. In either case the resulting mass is heated by means of an electric current in the absence of air *in vacuo* or in an atmosphere of a gas, or surrounded by an indifferent substance having no action upon tantalum. Under the influence of the heat produced by the electric current finally a welded or molten homogeneous metallic body is obtained which can be hammered or forged or rolled or drawn to wire or treated in any known mechanical way. The inventor prefers to reduce the homogeneous metallic body obtained in the above-described manner to rods or the like of suitable cross-section by pressing, rolling or a similar treatment, and then to draw filaments from the rods.

Boston Finance Commission and Street Lighting.

The Finance Commission of Boston has decided in sub-committee not to submit any report at present on the street lighting situation. In an interview with a representative of this journal recently, Mr. George U. Crocker, a member of the committee, stated that although he had made a casual study of several European systems on a recent trip abroad, nothing would probably be done until experts of the Edison Company and the Boston Consolidated Gas Company, who are now abroad, return with data secured in a thorough study of street lighting conditions there. Mr. Crocker was much impressed with the Welsbach street lighting as practised in Berlin, but did not imply that electricity could not meet the situation under Boston conditions.

Among the subjects taken up by the commission early in its work was the cost of street lighting, and in harmony with its policy of pointing out all possible economies, the commission has taken a special interest in this matter. Only a few weeks ago the Edison Company took over the public building lighting of the city on its regular basis of rates, thereby saving the city about $1,000 per month. The recent reduction recommended by the Gas and Electric Light Commission from 15 to 12 cents per kilowatt-hour will tend to benefit the whole city. The Edison Company has always shown a disposition to go more than half way in the supplying of information to bodies of this kind, even when considerable cost is involved for clerical labor and expert analysis. When all the data desired by the commission are in, it will render a report to the City Council and Mayor Hibbard.

Electricity in a Modern Hotel.

At a meeting of the New York Electrical Society, held at the Hotel Astor, on June 17, Mr. Frederick A. Muschenheim gave an interesting illustrated talk on the electrical equipment of the hotel, where about 900 motors are in use, and many ingenious electrical devices have been introduced for the convenience of the guests. A description of the isolated generating station and of many of the motor installations of the hotel appeared in our issue of Feb. 11, 1905. Since that time the motor applications have been greatly extended and many new uses have been found for electricity. It is noteworthy, however, that the load on the generating apparatus has not only increased, but has actually decreased, due to the introduction of improved lighting units, the high-efficiency tungsten lamps being much in evidence at the present time.

Among the devices that require almost no electrical energy, but prove of great benefit in facilitating the smooth running of the hotel, the most prominent is the telautograph, which is used for recording all orders given by the guests and transmitting them simultaneously to the employee who is to execute the order and to the chief of employees in order to insure their prompt execution. An order telephoned from the guest's room is immediately recorded in writing by the girl at the telephone central, which is also the "central" for the telautographic system. Simultaneously the order appears on the record sheet at the desk of the chief of employees and at the "substation" of the employee who must attend to the order, the exact time being recorded on each sheet. When the order has been filled the employee records this fact, together with the exact time on his sheet at his substation and simultaneously the chief of employees is notified of the act. This system of recording and transmitting eliminates the errors that accompany verbal orders, minimizes the time consumed in satisfying the wants of the guests, overcomes the disadvantageous crowding of the office, halls and elevators with employees, insures the maximum attention to duty on the part of each employee, and reduces the expenses to a minimum. A description of the telautograph was given in our issue for Dec. 8, 1900.

An equipment that has proved of great convenience is a system of miniature lamps of the telephone-switchboard type for indicating to the chief of employees at each instant the exact position in the hotel where each chambermaid may be found and for showing to each guest the room in which the particular maid in charge of his floor is working.

Each maid is provided with a key which serves as a switch handle for lighting a small lamp at the door as she enters a room and simultaneously lighting the indicating lamp at the desk of the chief of employees.

By means of an illuminated sign in the room of each guest he is notified immediately when mail matter reaches the office for him. The placing of a letter in the post-office box corre-

sponding to his room closes a switch connected with the lamp which illuminates the sign in the guest's room.

Many electric cooking, heating, cooling, ventilating, indicating and conveying devices are in use throughout the hotel, making the installation one of the largest, most varied and altogether interesting examples of the application of electricity to hotel service in existence.

Some Notes from Europe.

BY DR. LOUIS BELL.

My primary purpose in running over here was to study the new methods in illumination of streets, but to tell the truth, there are so many other things doing that I hardly know where to begin. Perhaps the thing that strikes one most forcibly is that with all the various phases of the American invasion electrical things are in the minority, almost non-existent. England and the Continent are full of American goods of every sort—whether you want typewriters, fountain pens, shoes, agricultural machinery or tooth powder, you can find the home article without any trouble at all. My door here has a door check made in Connecticut, and they ring up change in the restaurant on an American cash register.

But in electrical items it is different. Not only is our material *non ester,* as Artemus Ward used to say, but there are few signs of its coming even on a small scale. Of course, some American high-tension transformers may be found, and there are many street railway equipments built on the American lines, but of miscellaneous stuff extraordinarily little. One would suppose that American flush switches, push buttons and other, would be imported, or at least copied here, but the average Continental switch is built on the lines of a half-grown beer bottle and you have to dodge it as you go by. Nevertheless, in my present room the chandelier is independently controlled from three points—the side of the room, the head of the bed and just outside the inner door—which fact is respectfully put up to the American hotel proprietors for a good example. And the chandelier itself carries three 22-cp, 25-watt "Sirius" tungsten lamps—completely frosted—and purchaseable here even in small quantities for 62 cents.

To those of us who have been brought up to believe that all 220-volt incandescent lamps are to be condemned, the enormous use of 220-volt distribution in England and on the Continent comes as a rude shock. A good many 220-volt tantalum and tungsten lamps are in use, but the problem of their development has been an admittedly troublesome one, and engineers go slowly, while firm in the conviction that they will soon be here in quantity. They work their metal filament lamps at 2.5 watts per hefner for tantalum and 1.0 watt per hefner for wolfram here in Germany and are contented with slightly less life than we are looking for. Central-station practice, in fact, is on a rather different footing owing to the lower wages and less average hours of burning than with us. Current costs rather less to produce in Continental stations than with us and consequently the situation is changed.

The fact is that engineers here are actually doing in every day practice the things that we are too apt to denounce as theoretical or by some other bad language. For example, the better stations use stiff superheating, have no trouble with it, and reach an economy that would be unbelievable were it not backed up by the figures. They also design boiler units for nearly double the maximum capacity found in American practice, and work them day in and day out at an efficiency that is better than we get at home on a formal test. While some of our big stations do most wonderfully well within their limitations, there is much to be learned in steam practice here, and it is time to quit fooling with old fashioned methods.

Cheap labor, of course, shows its results in everything electrical, as also does a lower rate for money. Yet it is not all cheap labor that makes the difference, but difference of policy as well. For instance, the small motor consumer is fostered in Germany, and in Berlin they have a motor load to-day of more than 100,000 hp, much of it in small units. Current at 4 cents per kw-hour for power even to the smallest consumers, and motors, direct or alternating current, at half the American price, make it easy to get motor load and to keep it. The German central-station man does not eternally have the fear of gas engines before his eyes, for like the gas man he has substantially a flat rate and cheap apparatus for his customers. One thing that impresses one, however, is the very small number of fan motors in use. Apparently the less strenuous climate has something to do with it, but also there is a general thrift that makes a mark look big. Perhaps, too, there may be a hygienic theory that artificial cooling is bad—in the same way that ice is far less used here than at home. Be that as it may, the fan motor is not much in evidence as compared with any American city.

The one difference that impresses one most strongly is the absence over here of series working in lighting systems, save as they use several arcs across the distributing voltage with a substation resistance to replace the arc when it gets into trouble. This fact makes it extremely hard to make comparisons of cost with United States prices. It changes, in fact, the whole situation, even as regards competition with gas. Series incandescent street lights are pretty nearly unknown, so gas has the call in places where brilliant light is not needed. As to the arcs on multiple circuit, they are turned on not uncommonly by a man who goes from switch to switch, although there are many instances of separate mains for the street lighting.

One of the most interesting advertising novelties I have seen is one that may be known at home, but of which I have seen a good many examples here—a huge circle of lights surrounding the advertising matter. A narrow sector of darkness sweeps slowly around the circle and every half-dozen revolutions or so the sign goes out for a short period. Then the band of darkness sweeps around and around again calling attention to the next appearance. It sounds so simple—and yet the slow sweep of the dark band around a circle perhaps 20 ft. in diameter is about the most compelling thing I have ever seen in a sign. As a whole, electric signs are scarce as compared with any large American city—close economy again, I fancy. Lamps are surely cheap enough, as regards the ordinary incandescents, but, as everybody knows, less well sorted than the home product.

In elevators the electric and the automatically controlled types have certainly come in for a liberal share of patronage. A good many are of American design, but of somewhat slow speed. One freak which I stumbled upon in Amsterdam was a continuously running affair—merely a kind of slow-moving vertical coal conveyer with nicely finished buckets big enough to hold a couple of people. One steps in as the thing comes up or goes down and gets off when he gets ready. A very simple substitute for the escalator, but not adapted to handle large crowds in a hurry.

The most striking difference between American and Continental street-lighting practice can be very briefly stated. When they really start out here to light a street, either by electricity or gas, they put in enough lamps to do the job with a thoroughness not to be found in the United States anywhere that I have ever been. It is not because lighting is wonderfully cheap here, for it isn't, but just from an innate desire for thoroughness. Side streets are often badly lighted here as everywhere. If the city fathers in American cities did the really important lighting as well as it is done over here in mere number of lights provided, the electrical business would start on a fresh boom. The low illumination we tolerate would be looked on with contempt here, provided the street concerned was considered worth a serious effort at proper lighting at all.

I have at last found some wooden arc light poles in Germany. There are not many of them and they terminate in the conventional iron shepherd's crook—but they are real wood. One does not wonder at their absence, however, in traveling through Germany. It has been sadly shorn of its forests since our skin-clad Saxon ancestors hunted the stag and wolf and worried the Romans, but this much is to be said, the Germans are making most determined efforts at reforestation, efforts that ought to make us blush at our own negligence. Especially is this true

of Saxony, where the forest legislation is most comprehensive, but you see plantations all over the Empire. In France and Belgium, too, I noted great activity in forestry. With our conditions of relatively scattered population we could work wonders with comparatively little effort. The lack of wood and the need of rigid economy in its use are well shown here by the tiny telegraph poles taking their wires commonly in vertical ranks.

To recur to things more strictly electrical, I was much interested in Hamburg to see the new Siemens-Schuckert single-phase railway. It runs very smoothly and seems to be doing admirable work from all I can learn. Its most striking external feature is the very pretty superposed catenary suspension with which Americans are somewhat acquainted from descriptions—a common catenary suspension carrying a bearer wire from which the working conductor is carried. The arrangement is beautifully aligned and seems to give an exceptionally good opportunity to adjust the deflections due to expansion and contraction. A similar road, just being completed, runs out of The Hague to Scheveningen, where I observed it first, en route. Bow trolley, of course, although one sees here so many American tramways that the wheel trolley seems to be at least a strong minority. I have heard nothing more about the proposed high-speed electric line from Hamburg to Berlin. Business is bad hereabouts—25 great freighters lying at their moorings idle in the outer harbor of Hamburg—so it may be some time before any big enterprises materialize. And government control, of course, makes for slowness, particularly in the telephone service, which in every place I have tried has been something not to be spoken of in polite language. The government railway service has greatly improved, however, in the last decade, though I cannot help wondering what would happen if one of our huge express locomotives got hold of one of these light Continental trains. In details, however, the locomotives are ahead of ours—superheating not infrequently and regularly the piston valve gear that American roads are just beginning to introduce. In France and Belgium there are many electrically-lighted trains, but in Germany the Pintsch gas mostly. A good many provisions are being made in suburban service. I found Hamburg in the throes of subway construction—a la Boston, with the cars to come out of their hole upon a raised way—and like Boston, too, in that the subway will have to go below the tide level, Hamburg being largely on made land.

In electric lighting matters in spite of the splendid display of new illuminants the interior fittings are very inadequate. There is little proper shading of the tremendously bright metal-filament lamps, unless they chance to have frosted bulbs, and distributed shades are almost unknown. I have seen some blood-curdling examples of interior wiring, too, enough to make the Board of Fire Underwriters take to drink. On the other hand, they use here small incandescent lamps far more than we do and sometimes with very admirable results. With lamps at Continental prices one can afford to be lavish in such ways, especially if one chances to be in a district where current is cheap, which it generally is not, although here and there the figures are very reasonable indeed. The completeness of underground service is extremely striking, but again with cheap German labor, cables can be cheaply made and laid—often cables served with prepared jute and laid without ducts. They are making beautiful high-tension cables now, from 20,000 volts to even 40,000. Of the former class some hundreds of miles have been supplied to English undertakings by the Allgemeine Electricitäts Gesellschaft. A word about German labor may not be out of place. It seems to be on the whole paid less than half the American rates, a discrepancy which counts tremendously when it comes to figuring things for export, but which does not, of course, represent the downtrodden workingman in anything like the same ratio. Two marks here is pretty nearly the equivalent of a dollar at home in every-day matters, and what is more important and less well known, the methods of manufacture and sale make employment more regular just as in England, which counts for much in the year's receipts. The steady percentage of young men serving their time in the army, too, has a considerable bearing on the general problem of the unemployed. And habits of living, of course, count for much in the matter; a people that has endured uncomplainingly for years the Harveyized German brödchen can get along under pretty strenuous conditions. In spite of all this the invasion of American goods fairly amazes me every day. American "Vienne" coffee pots for example I have seen to-day; also American revolvers, not of the highest grade, but still conspicuous for excellent design and finish. Yet in electrical things, especially the smaller ones, there is little doing. There ought to be a market for the admirable interior fittings we turn out, and American machine methods ought to bring them here at an attractive price. I have not time to make a study of such details, but it certainly would be well worth some one's while to investigate the trade conditions and see whether more could not be done here. Of course, very many things of ours are not and cannot be patented in Germany, yet we send certainly already goods that are not protected but make their way on a strictly commercial basis.

The Helion Incandescent Lamp.

It is announced that the Helion incandescent lamp is about ready for commercial use. Prof. H. C. Parker and Mr. W. G. Clark, the inventors, have developed a filament which they say is in its final form and that only mechanical details have now to be completed before the lamp is ready for the market. The filament, as completed, possesses certain very interesting features. It looks like a section of Russia iron and can be handled almost as carelessly as a piece of wire, although it is somewhat more brittle. The filament is short, coarse and strong, and is made by flashing a carbon core and producing a deposit of Helion composition on it. The finished filament has from three to five times the diameter of the carbon core, and possesses a very high resistance. Helion has a specific resistance 50 times that of carbon.

A remarkable feature of the filament is that it can be heated to incandescence in the open air and resists attack for quite a

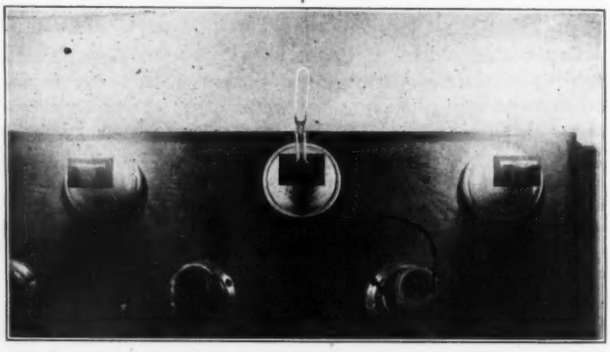


FIG. 1.—HELION FILAMENTS BURNING IN AIR.

long period of time. Another quality is that, being short, it is necessarily immune from the detrimental effects of vibration. Work on the filaments has reached such a point that they are standardized for 110- and 220-volt circuits. It is proposed to make the lamps in standard ratings of 20 and 40 cp, and for regular voltages. The filament for the 220-volt lamp is 3 in. long and that for the 110-volt lamp of half the candle-power rating is, of course, only half that length. When heated in the open air the filament shows the pure white light which was characteristic of the lamp when first exhibited.

The filament when burning in air is, of course, not so efficient as when enclosed in a globe, and especially in a vacuum; but even in air it gives a brilliant white light. A peculiarity of the filament is that as soon as it is heated, the surface oxidizes and a protective skin is said to be formed which guards it from further attack. The life of the filament burning in air has not been determined, since obviously it is not intended to be used in this way, but enclosed in an ordinary incandescent lamp bulb.

An interesting point, especially when viewed in connection

with the filaments of other recently developed lamps, is that the cost of the Helion filament is stated to be little more than that of the ordinary carbon lamp. Thus, while the lamp is claimed to have a higher efficiency than that of other lamps recently

FIGS. 2 AND 3.—HELION LAMP FILAMENTS BURNING IN AIR.

placed on the market, its cost is very much less. It is also claimed that a high vacuum is not necessary, so that the slight increase in cost due to the filament itself is partially offset by the saving due to a lower vacuum.

Fig. 1 is a photograph of two Helion lamps burning in air in the laboratory of the inventors. Fig. 2 shows multiple filaments for 110-volt or 220-volt circuits, or both, and Fig. 3 shows the multiple filament, one-half of which is burning. Both views show the filament in air and give an excellent idea of its size.

Device for Solving Alternating-Current Problems.

Mechanical calculating devices have two distinct advantages over the long-hand method: They save time and they cannot make a mistake. The slide rule, which has become an indispensable part of every engineer's equipment, cannot be used in operations where addition or subtraction is involved, and, therefore, is of little use in the solution of the equation $A = \sqrt{B^2 \pm C^2}$, which is so often encountered in alternating-current work. Moreover, the solution of trigonometric problems by the slide rule is somewhat tedious. The device described below is especially adapted to the solution of these very prob-

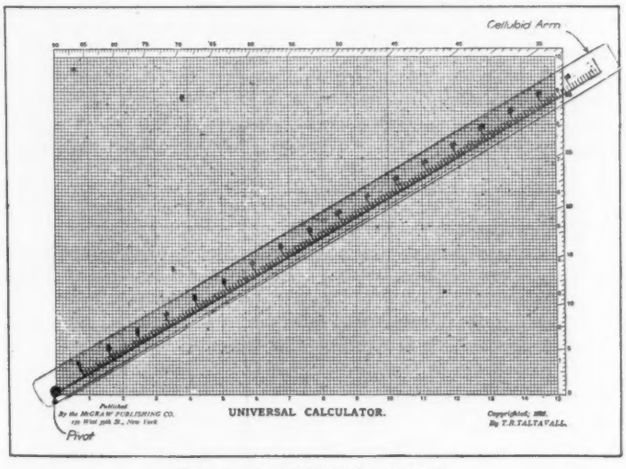


FIG. 1.—CALCULATING CHART.

lems, and should therefore be heartily welcomed by all who have occasion to deal with vector quantities.

The Universal Calculator, as it is called, is the invention of Mr. Thomas R. Taltavall. It consists of a heavy piece of cardboard (7 in. x 9 in.), on one side of which is printed a chart, which is nothing other than cross-section lines divided up according to the decimal system. A transparent celluloid arm is pivoted in the lower left-hand corner. This arm is provided with a linear scale exactly similar to the linear scale on the chart. This scale is printed on the lower side of the celluloid so as to avoid errors due to parallax. In addition to the two linear decimal scales, the upper and right-hand edges of the chart are provided with an angular scale, which gives the angles included by the arm and the lower side.

Although the Universal Calculator can be used for all kinds of calculations involving multiplication, division, etc., it is especially suited to calculations involving the use of trigonometry. It is immediately apparent from Fig. 1 that the arm can be placed so as to construct any given right-triangle, and that the hypothenuse, the sides, and the included angle can be read off directly from the various scales. In cases where the triangle is not a right-triangle, it must be divided into two right-triangles, and each one solved separately; therefore, two settings of the arm are necessary in this case.

Fig. 2 shows the so-called trigonometric lines. O corresponds to the pivot of the arm; $O\ S$ to the arm, D to the point 10 on the arm, $A\ T$ to the heavy scale line passing through 10 on the horizontal scale, and the $B\ S$ to the top line of the chart. Now it is well known that if the angle $S\ O\ A = \theta$, $O\ C = \cos\theta$,

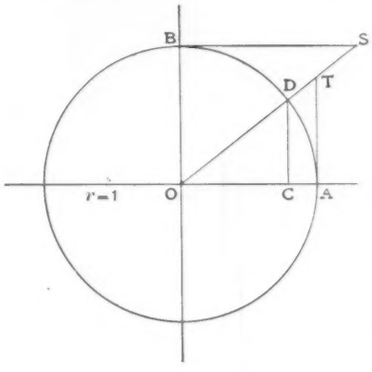


FIG. 2.—TRIGONOMETRIC LINES.

$C\ D = \sin\theta$, $T\ A = \tan\theta$, $B\ S = \cot\theta$, $O\ T = \sec\theta$, and $O\ S = \csc\theta$.

Referring to Fig. 1, the arm is placed at 30 deg. Reading to the right from the point 10 on the arm, sin 30 deg. is found to be 0.5; reading down from the same point, cos 30 deg. is found to be 0.866, and then reading to the right from the intersection of the heavy line (10) with the arm scale line tan 30 deg. is found to be 0.578.

In alternating-current work the problems involving quadrature vectors are solved with the greatest ease, and the power-factor, as well as the angle of phase displacement, may be read off at once. For instance, assuming the setting given in Fig. 1, if the resistance were 13 ohms, the reactance would be 7.5 ohms, the impedance 15.1 ohms, the power factor 0.866, and the phase angle 30 deg. The chart is well adapted to the solution of complex alternating-current problems involving series reactance and resistance, and shunted conductance and susceptance; impedance and its two vector components can readily be converted into the equivalent admittance and its two vector components.

Another important application of this device is in the solution of problems involving a straight-line ratio. For instance, if it is desired to convert meters to inches, set the arm so that it will intersect the upper border line of the chart at 39.4 units from the left-hand edge; then if the horizontal scale is considered to represent inches and the vertical scale meters, any number of meters can at once be changed to inches, or *vice versa*, by starting on one scale following the scale line to its intersection of the arm, and then proceeding from that point to the other scale where the corresponding number of the other kind of units will be found.

Hearing on Light and Power Contracts.

At the hearing June 17 before Commissioner Milo R. Maltbie, of the Public Service Commission of New York City, into the contracts of the local electric-light and power companies Mr. Frank W. Smith, secretary of the United Electric Light & Power Company, was the principal witness. Mr. Smith said that his company had 83 special contracts in which retail customers were allowed 10 per cent discount in consideration of making lamp renewals, and 14 old customers who received service at the old rates prevailing before the advance of July, 1905, was made. Mr. Smith said that the company no longer made contracts allowing discounts for lamp renewals because it wanted to discourage customers from making their own renewals. He admitted that it was more profitable to the company to make its own renewals than to allow the discount.

Mr. Smith filed with the commission a full copy of all the riders and special clauses which his company places in its wholesale contracts. The breakdown clause which covers the installation of auxiliary service to private plants does little more than provide a minimum yearly consumption and a recompense for putting in the service. The same provisions as used by the New York Edison Company were presented to the customer who accepted the 120,000 kw-hour contract. The consumption of tenants is allowed to count on the total of the landlord. All of the contracts contained the 30-day cancellation notice. In the case of new buildings, the minimum guarantee is waived for six months, the 120,000 kw-hour clause dating from six months after the contract actually begins, but in that time the 5-cent rate applies. The contract also stipulates that the customer can change to a standard form of contract at any time he desires. Mr. Smith testified that the reason for giving the 5-cent rate to landlords or lessees was to get the guarantee of 120,000 kw-hours' consumption, and also to secure a six-year contract. He also said that the rent-free space in large buildings for transformers was a very valuable consideration and that his company always availed itself of the privilege. He said that the discontinuance clause was no serious disadvantage to this class of contract because the experience of the company was that once the service was begun it generally continued. This was especially true, the witness said, because his company used the alternating current, and its apparatus was not suitable for any other service.

In answer to the commissioner's direct question, Mr. Smith said he saw no objection to making all the various forms of contract and rates offered by his company public and of offering the same privileges to all consumers. He said that his company was preparing a pamphlet embodying all of these riders and provisions. The commissioner asked the witness to produce the company's books at the next hearing, June 22, so that an estimate could be made of how much the company profited by the guarantees of quantity of consumption and hours of service.

At the hearing on June 22 Mr. W. W. Freeman, general manager of the Brooklyn Edison Company, was recalled for further examination as to the special contracts of his company. Mr. Freeman said that one special contract with a large consumer was for a term of six years without limitation clause and that the consumer guaranteed to use $10,000 worth of current per year. Under this contract he paid 3⅓ cents per kw-hour for the first 525,000 kw-hours and 3 cents for all above that amount. Mr. Freeman said that the company had prepared recently a standard wholesale power contract running for five years under which the rates varied from 5 cents to 3.05 cents per kw-hour, according to quantity of current consumed. He admitted that with very large consumption the special contract cited would average a higher rate than the new contract. The witness told of one special contract, for four years, at a rate of 2¾ cents per kw-hour, with a guarantee of $10,000 yearly, and another with the same guarantee running for 10 years, the terms of which were 3¼ cents per kw-hour for the first 250,000 kw-hours, 2¾ cents for the second 250,000, and 2½ cents for all over 500,000. Other special contracts were shown at varying rates, one a two-year contract with a guarantee of $15,000 per year, the rate ranging from 2½ to 2 cents per kw-hour. Many of these special contracts, Mr. Freeman said, were experimental and made by the company to fit especial cases. Mr. Freeman said that the company was always willing to give a new customer all the benefits bestowed upon an old customer similarly situated. He admitted, however, that the terms of these special contracts were not made public, and a prospective customer would have to know of them from private sources.

Canadian Electrical Association Convention.

The eighteenth annual convention of the Canadian Electrical Association was held June 17-19 in Toronto, which city, owing to the large number of conventions meeting within it, has acquired the name "Convention City of the Dominion of Canada." About 200 delegates were in attendance from all parts of the Dominion, together with a number of visitors from the United States. The majority of those present were central-station men and engineers, but the supply houses were also largely in evidence. Among those noted as being present from the United States were: Messrs. C. R. McKay, Toledo Railways & Light Company, Toledo, Ohio; Philip H. Hoover, N. Y. Insulated Wire Company, Herman P. Kimball, Standard Underground Cable Company, and Geo. Williams, all of New York.

The managing committee, to whom is due the success of the convention, was composed of Messrs. R. G. Black, A. A. Dion, B. F. Reesor, C. B. Hunt, J. M. Robertson, J. J. Wright, W. Williams, H. O. Fisk, J. W. Purcell and J. G. Glassco. These gentlemen, with the assistance of the president and secretary, did everything in their power to provide entertainment for the delegates and visitors.

On Thursday afternoon at the close of the session the election of officers took place and resulted as follows: President, Mr. W. N. Ryerson, general superintendent, Ontario Power Company, Niagara Falls, Ont.; first vice-president, Mr. R. M. Wilson, general superintendent, Montreal Light, Heat & Power Company, Montreal; second vice-president, Mr. P. S. Coate, Chatham Gas Company, Chatham, Ont.; secretary-treasurer, Mr. T. S. Young, Toronto. Managing committee: Messrs. R. G. Black, Toronto; A. A. Dion, Ottawa; B. F. Reesor, Lindsay; Chas. B. Hunt, London; J. J. Wright, Toronto; W. Williams, Sarnia; H. O. Fisk, Peterboro; J. W. Purcell, Walkerville; W. A. Pearson, Niagara Falls, and R. S. Kelsch, Montreal.

The chair was occupied by the president, Mr. R. S. Kelsch, consulting engineer of the Montreal Light, Heat & Power Company, Montreal. Addresses of welcome were given at the opening session by Alderman Graham on behalf of the corporation of the city, and by President Faulkner and Professor Galbraith, on behalf of the University of Toronto, it being due to the kindness of these gentlemen that the convention was permitted to be held in the Chemistry and Mining Building of the University. President Faulkner during the course of his address stated he recognized that the relations between the Canadian Electrical Association and the University should be close, and that the work of electrical engineers would contribute very largely to the practical efficiency of the industrial life of the community in Canada as a whole.

The secretary-treasurer, Mr. T. S. Young, presented his annual report, in which he stated that a special effort which had been made to interest a large number of private light and power companies in the association had resulted in 92 of such companies joining. A deputation, he said, had waited on the Dominion Government on Feb. 12, 1908, and in consequence the registration fee for inspecting gas and electric meters had been abolished, effecting a saving of $6,000 to the lighting companies.

President Kelsch in his address referred to the severe and trying time due to the financial panic which had occurred since the last meeting; but after traveling over some 4000 miles of Canadian territory he was of the opinion that Canada was on the upgrade. A comparison of steam and electric roads showed that the electric roads had stood the test better than the steam roads. Referring to the tungsten lamp, he thought it would be a benefit to both the lighting stations and to the consumer, and the decrease in revenue due to its use would be more than offset by its high efficiency and increased sale.

During the morning and afternoon sessions on Wednesday the following papers were read and discussed: "Power Rates and Factors Which Influence Them," by Mr. W. N. Ryerson, general superintendent of the Ontario Power Company, Niagara Falls, Ont.; "How to Increase the Station Load," accompanied by lantern slides, by Mr. Geo. Williams, New York City; "Lost and Unaccounted for Current," by Mr. C. R. McKay, Toledo Railways & Light Company, Toledo, Ohio; and "Various Electrical Power Plants by European Designers," by Mr. C. H. Mitchell, consulting engineer, Toronto.

In the first-mentioned paper Mr. Ryerson stated that the factors which have the greatest influence upon rates to be charged were, first, the distance of the customer from the source of supply; second, the amount of power the customer desires to use; third, the character of the customer's load. The first two factors were well understood and required little comment. The question of the third factor, however, was by far the most important element entering into the cost of supplying power. The three principal methods used in charging for power are, the flat rate, the meter rate and the sliding scale. A fourth method, which had only a limited application, is what has been termed "Second Class Power." The meter rate was the most universally used and best understood method of charging for power. However, the writer of the paper, while he held no brief for any particular method of charging, preferred what he had described as the "Sliding Scale" method, especially where power is derived from waterfalls, on the ground that it offered greater inducements to raising the load factor. In conclusion he said that fortunately there has, so far, been no legislation in the Dominion of Canada regarding rates for electric light or power, and it would seem that the various members of the association should be on the alert to forestall and prevent such legislation, by so adjusting their rates of charging that no inequality or unfairness could be claimed. Such a course would in a large measure forestall any legislation, which was almost certain to be detrimental to power companies.

Mr. Dion, of Ottawa, in discussing this paper stated that taking everything into consideration he thought for the sale of small units the meter rate, together with a flat rate based on the total installation and the size of the motor, were the nearest to meeting properly the conditions without running into complications.

Mr. Williams in presenting his paper gave point to his arguments by a series of lantern slides showing the large and ever increasing revenue which was being obtained from illuminative sign lighting, decorative lighting and outline lighting, which line of business was rapidly developing in the large towns and cities of the United States.

The paper by Mr. Mitchell on "Power Plants by European Designers" was devoted largely to the hydraulic side of the question, and was historical and descriptive of the different types in use in southern France, Italy, Switzerland and the Austrian Tyrol. In connection with his description Mr. Mitchell threw on the screen upward of 100 views taken by him with his camera while on a trip through the different countries mentioned.

On Thursday the papers presented were as follows: "Modern Street Lighting," by Mr. A. E. Fleming, Canadian Westinghouse Company, Ltd., Nernst Lamp Department, Hamilton, Ont.; "Electrical Franchises: Their Legal Status and Basis of Valuation," by Mr. Jas. Bicknell, King's Counsel, one of the leading members of the bar of Ontario; "Contracts," by Mr. Robert McKay, King's Counsel, of the well-known law firm of Messrs. Johnston, McKay & Company, of Toronto; and "Electrical Plant Earnings Per Capita," by Mr. W. A. Bucke.

Considerable discussion took place during the reading of Mr. Fleming's paper on the respective merits of the tungsten lamp, the Nernst lamp, the flaming arc lamp, and other forms of open and enclosed arc lamps, during which Mr. Fleming pointed out that the cost of maintenance had to be considered more than the cost of furnishing.

Mr. Bicknell's paper dealt with the subject of electrical franchises in a very comprehensive manner under the following heads: Who had the right to grant franchises; conflict of franchises; stringing wires over private lands; sale of franchises on execution; revocation or alteration of franchises; taxation of franchises; expropriation; municipal competition with electrical companies; nuisances; and basis of valuation of franchises. Mr. Bicknell at the close of his paper answered many questions put to him by the delegates.

Mr. McKay's paper on contracts emphasized one point in particular, namely, that when you come to draw a contract which will be satisfactory or proper, whether a business man or a lawyer is doing it, the first thing is to sit down and think out and know precisely what you want and all that you want; and when you have got that far you have taken the longest possible step in getting your contract ready.

A paper on "Regulation of Electric Currents or Circuits" was to have been read by Mr. W. G. Chace, of Toronto, but owing to his unavoidable absence from the city the main features were dealt with by Mr. R. G. Black, of Toronto, and in doing so, he illustrated by the use of slides the principal forms of regulators in use at the present time.

On Friday papers were read as follows: "Grounding of Transformer Secondaries," by Mr. W. L. Macfarlane; "The National Electric Code," by Mr. H. F. Strickland; and "The Oscillograph," illustrated with slides and instruments, by Mr. H. W. Price, consulting engineer, Toronto.

The subject of the grounding of transformer secondaries was one which caused considerable discussion. The president stated that it was a subject of great interest to all central-station men; a great deal had been said lately upon the subject; some of the companies having adopted one method and some another; some had criticised the pipe ground and on the other hand some of the best engineers said the pipe ground was all right. He further stated that he had learned a short time ago that the Boston Edison Company had made a rule that it would not connect up to a new customer unless the wiring in the house was provided with a permanent ground installed by the firm which did the wiring. In Montreal during the past two years approximately 40 per cent of the lighting transformers have been grounded, but the question of grounding 550-volt motor systems has not yet been decided. Water pipes are not used for grounds, but this matter is being taken up with the authorities with a view to using the water pipes for this purpose. Present practice in Montreal is to ground the neutral of pole transformers by means of No. 4 copper wire stapled to pole and soldered to a galvanized iron rod driven 8 ft. into the ground. A piece of pipe is used to protect the ground wire for a distance of 8 ft.

The exhibition of the oscillograph by Mr. Price closed the convention proper, after which the members took luncheon together and were then treated to an illustrated lecture on the large power plants of America, by Mr. R. J. Clark, of the Toronto Railway Company, describing some of the most difficult power house work that has ever been done in America, notably in Sao Paulo, Mexico, Niagara Falls and Winnipeg.

SOCIAL FEATURES.

The social features of the convention consisted of the following: A moonlight excursion on Lake Ontario, the opening of the University Science Buildings for inspection, a demonstration of electro-metallurgical apparatus by Mr. Saul Dushman, a special trip by street railway to Scarboro Beach Park, an afternoon tea for the ladies at the Royal Canadian Yacht Club, Centre Island; a drive around the city and a baseball match between representatives of the manufacturers and operating companies at Maple Leaf Park, Hanlan's Point.

By courtesy of the management of the various companies arrangements were made whereby all persons wearing the association badge were permitted to visit the power plants and distributing stations in the city at any time, a map being provided showing the location of these different stations. The Toronto Railway Company very generously gave free transportation during the convention to all wearing the association badge. The Bell Telephone Company also provided a service in the convention building specially for the accommodation of members.

CURRENT NEWS AND NOTES.

MICHIGAN ELECTRICAL ASSOCIATION.—The next annual meeting of the Michigan Electrical Association will be held at Grand Rapids, Mich., Aug. 18-21. Mr. A. C. Marshall, Port Huron, Mich., is secretary.

RICHMOND ELECTRICAL SHOW.—The Richmond Passenger & Power Company is arranging for an electrical show to be held in Richmond, Va., in the near future. The educational part of the exposition will be in charge of Mr. John W. Foster, of New York.

WIRELESS ON THE LAKES.—The Detroit & Cleveland Navigation Company has wireless telegraph stations at Buffalo, Cleveland, Detroit and Port Huron, and will establish another station in Toledo. All the steamers of the company are now equipped with Clark wireless telegraph apparatus.

HUDSON TUNNEL EXTENSION OPENED.—Beginning Monday, June 15, regular service was established in the McAdoo tunnel between Hoboken and New York City as far north as Twenty-third Street and Sixth Avenue, New York.

ABUSE OF LEASED TELEGRAPH WIRES.—It is announced that the Western Union and Postal Telegraph companies will abolish their leased wire service to brokers, on the ground that undue advantage has been taken of the leases by brokers diverting business away from the telegraph companies. It is stated that some brokers have even solicited outside commercial business at one-half the usual rate.

ELECTRICAL SHOW IN WORCESTER, MASS.—The Worcester County Mechanics' Association has decided to hold an electrical and mechanical exhibition in Worcester next February. The arrangements for this have been placed in charge of a committee composed of President Daniel E. Denney, of the association, and Messrs. Julian F. Bigelow and Charles H. Norton.

SOUTHWESTERN ASSOCIATION QUESTION BOX.—Mr. Samuel Kahn, of the San Antonio Gas & Electric Company, editor of the question box of the Southwestern Electrical and Gas Association, has published the question box this year in book form. The matter takes up 167 pages and covers practically all departments of electric and gas business. Both questions and answers are well selected, and the result as a whole reflects credit on the association and its editor.

COLUMBIA UNIVERSITY SUMMER COURSE IN ELECTRICAL ENGINEERING.—One of the summer courses in engineering that will be given at Columbia University, July 7 to Aug. 14, will be in electrical engineering. This will consist of lectures six hours per week by Prof. C. O. Mailloux on electric train movement. Prof. C. E. Lucke will be in charge of a course having gas engines as its subject, consisting of six hours of lectures and the same number of hours of laboratory work weekly.

GOVERNMENT EXAMINATIONS FOR ELECTRICAL ENGINEER.—The United States Civil Service Commission will hold examinations in various parts of the country on July 22-24 to secure eligibles for one or more vacancies in the position of electrical engineer and mechanical draftsman in the Reclamation Service. The entrance salary is $100 to $200 per month, and eligibles may be appointed as electrical engineers or assistants for the design, installation or operation of hydro-electric and steam-power plants in the West, or as mechanical draftsmen for office work and drafting in connection with the preparation of plans.

NEW TELLURIDE POWER PLANT.—Preliminary tests have been completed on the first 20,000-hp unit of the new power plant of the Telluride Power Company, at Grace, Idaho. The power for this plant is furnished by the natural flow of the Bear River, and the water stored in Bear and North Lakes, which have been converted into natural reservoirs. The station building is designed for an ultimate capacity of 80,000 hp. The pipe line is 8 ft. in diameter and six miles long, the net head being 540 ft. This is the sixth plant added to the system of the Telluride Power Company in territory tributary in Salt Lake City.

CONVENTION TELEGRAPHIC SERVICE.—It is estimated that during the meeting in Chicago of the Republican convention no less than 5,500,000 words were sent by telegraph. The two telegraph companies and the several press associations had prepared to handle 1,200,000 words a day from the convention hall, and large corps of bicycle messengers were organized to take overflow matter to the main city offices. The Western Union Company had 110 circuits from Chicago to New York City, and 150 expert operators were on duty, in addition to those detailed from the Chicago staff. The Postal Telegraph Company had 135 extra operators on duty.

ANNUAL MEETING OF N. Y. E. S.—At the annual meeting of the New York Electrical Society, held in the Hotel Astor on June 17, the following officers were elected: Messrs. Henry A. Lardner, president; W. Noble Dickinson, Jr., J. C. Forsyth and S. D. Sprong, vice-presidents; George H. Guy, secretary, and H. A. Sinclair, treasurer. The secretary's report showed that the society now has a total membership of 880, an increase of 49 over the number last year. Mr. Frederick A. Muschenheim delivered an address on "Electricity in the Modern Hotel," an abstract of which is published elsewhere in this issue. After the address the electrical equipment of the hotel was thoroughly inspected.

UNIVERSITY OF MINNESOTA ENGINEERING COURSES.—The University of Minnesota will increase the length of its engineering courses from four to five years, and at the same time has arranged to increase to a small extent the amount of technical work. The increase is, however, intended principally to enable students to take up more general culture studies than in the past, as it is believed that this will result in turning out a better grade of engineer. The added work consists of additional requirements in modern languages, economics and political science. The first year is uniform for all engineering courses. As the first four years provide a good general education, the degree of bachelor of science will be given at the end of the fourth year. Most of the purely technical work will go in the fifth year, upon the completion of which the student is eligible to the degree of electrical engineer.

LEMOINE, DIAMOND-MAKER.—Last week the sealed envelope containing Lemoine's formula for the manufacture of diamonds was opened in a French court, and several gentlemen eminent as financiers and engineers learned definitely how badly they had been duped. These instructions specified the placing of carbon and sugar in a crucible, passing through the same an electric current of a certain quantity and voltage, and then subjecting the crucible to pressure, whereupon diamonds would be formed. Lemoine, who was out of prison on bail, disappeared the day before the envelope was opened. On the strength of his claims Lemoine obtained from Sir Julius Wernher, the South African "diamond king," $320,000. Part of the arrangement was that the secret for making the diamonds was to be written out and enclosed in an envelope which was to remain unopened until the death of Lemoine and then to become the property of Sir Julius. In order to have the sealed envelope produced in court, long legal proceedings, both in London and Paris, were necessary.

Electrical Equipment of the Forrest Theater, Philadelphia, Pa.

THE Forrest Theater is the latest Philadelphia playhouse. It is located on Sansom Street, near Broad Street, and it is so laid out that it has its main entrance on the latter street, while there is a stage entrance and ample exits on Sansom Street. The theater, which is of elaborate modern design, has a seating capacity of 2000 persons, of which nearly 700 are accommodated on the main-floor level and over 600 in each of the galleries. The building is of unusual design, being built of reinforced concrete and having in its main and side entrances a novel arrangement of corridor inclines, permitting entrance direct to either main floor or balcony without the use of stairs. By this means it is possible to dismiss the audience in a minimum of time and with a minimum of risk in case of a panic. Mechanically and electrically the building fulfills all the requirements of the fire underwriters.

All of the electrical energy used in the building for lamps and motors is supplied from the mains of the Philadelphia Electric Company. Three 100,000-circ. mil cables tap the electric-light company's service mains on Walnut Street and three cables of the same size are brought in from Broad Street. These two services are fed from different substations and the different centers of distribution are connected so as to distribute the load between the two services. By this means the theater is not dependent upon one substation for its energy, and while normally both sources of supply are utilized, connections are provided for receiving the supply from one service should the other service be interrupted. The energy is bought at the rate of 6 cents per kw-hour and the average cost for eight performances per week is $150, or $18.75 a performance.

The mains and sub-mains for lamp circuits are installed on the three-wire system, and the distributing circuits and cut-outs are arranged on the two-wire system. The motor circuits are connected across the outer wires of the three-wire system. The wiring throughout is run in iron conduit. The necessary mains for the various circuits are brought to a distributing center located in the basement. From this center feeders run to the various cut-out centers on each floor. The Philadelphia Electric Company's mains are brought to this service board as shown in Fig. 4, and the circuits are arranged so that the lamps in the theater, the lamps in the offices and the motor circuits can be controlled separately. There are seven meters installed; two for stage-lighting circuits, two for the house-lighting circuits, one for arc-lamp circuits, one for the electric signs, and one for the motor circuits. It will be noticed that the three mains of one service are brought to the front of the meter panels, while the three mains of the other service are brought to the rear of the meter panels. The cut-out for each stage- and house-lighting meter is connected to the service mains so that one is fed from the Walnut Street service and the other from the Broad Street service. The cut-outs for the other meters are arranged so that the load can be supplied from either service.

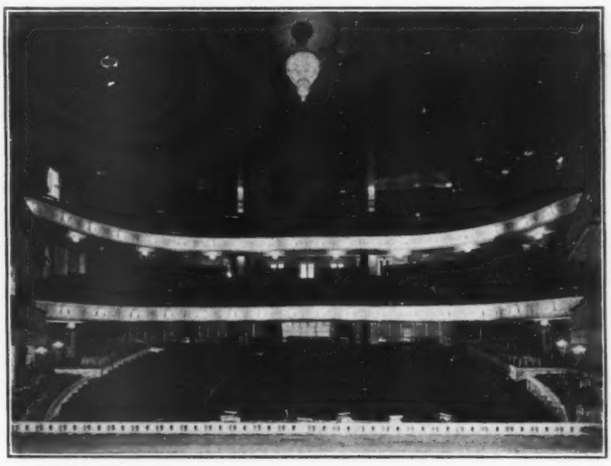


FIG. 2.—VIEW OF AUDITORIUM FROM STAGE.

The stage switchboard is shown in Fig. 5. Return mains are brought back from this switchboard to supply all lamps in the auditorium, etc., which are required to be dimmed or controlled from the stage switches. A distributing center for the theater lighting is provided in the front of the house at a point convenient of access from the main foyer. This distribution center contains the switches for controlling exit lamps, stairway lamps, lamps in the lobby, passages, gradients, etc., and these lamps are independent of all control from the stage switchboard. The circuits controlling the inside and outside exit, stair and passage lamps have the switches controlling them equipped with a locking device arranged with a key lock. The stage switch-

FIG. 1.—SANSOM STREET LOBBY.

FIG. 3.—BROAD STREET LOBBY.

board is located in a fireproof compartment equipped with an iron roller shutter.

The orchestra pit is wired for 30 one-lamp outlets distributed along the front and back rails, with receptacle sockets for cord extensions. These outlets are controlled from the stage. The receptacle sockets for the footlights are set in a sheet-metal case on the inside of a metal trough. There are 120 32-cp outlets provided and these are arranged in four circuits for colored lamps alternating throughout the length of the footlight trough. Each circuit is controlled by a separate switch on the stage

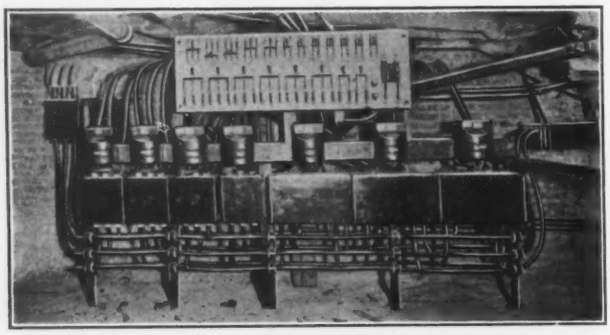


FIG. 4.—SERVICE CONNECTIONS AND METERS.

switchboard. The lamps are apportioned as follows: 48 white, 24 red, 24 blue and 24 amber. There are five sets of border lamps, each arranged on a strip 38 ft. long, and one set arranged on a strip 25 ft. long. The lamps are wired on four circuits; three circuits containing 24 lamps and one circuit containing 48 lamps. The lamps are all rated at 32 cp. The border-lamp circuits are connected to iron outlet boxes located over the center of the border strips by a flexible cable of sufficient length to permit the border strips to be lowered to the stage floor without disconnecting the cable. For the proscenium there are two strips 18 ft. long situated one on each side of the proscenium opening. Each strip contains 60 32-cp lamps protected by a heavy wire screen.

On each side of the stage, outside of the sink line, five stage pockets are provided, and two pockets are provided in the rear

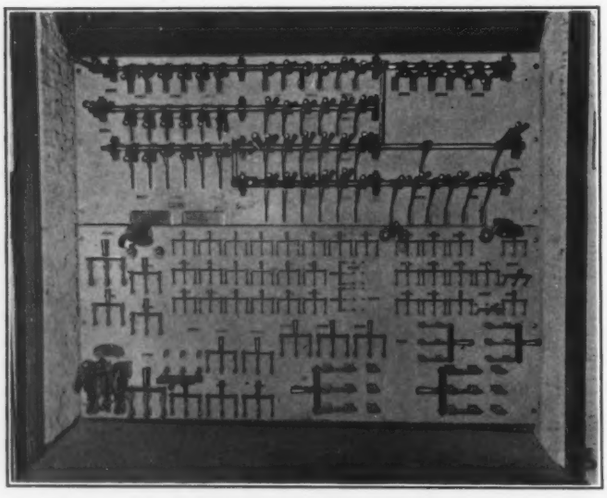


FIG. 5.—STAGE SWITCHBOARD WITH SLIDING METAL DOORS.

of the sink line. Each pocket is equipped with three receptacles; two of each are for bunch-lamp circuits and the other for an arc-lamp circuit. Each receptacle is provided with a slip plug and the arc-lamp circuit receptacles are all arranged for like polarity, the plug fitting one way only. A circuit runs from the stage switchboard to arc-lamp outlets in fly-galleries, stage pockets and proscenium bridges. This circuit is rated at 300 amp and is divided into four branch circuits as follows: One circuit feeding six pockets on the right-hand side and rear of the stage; one similar circuit for the left-hand side and rear of the stage; one circuit to feed proscenium bridge outlets, and one for fly-floor outlets on the right-hand side of the stage. The two proscenium bridge outlets are rated at 50 amp each, and the three fly-floor outlets are rated at 75 amp each. In the gallery rail and in the balcony rail at the foot of the center aisle are placed iron junction boxes. Each of these boxes is wired for 100 amp, and three outlets are provided from the box in the gallery and two outlets from the box in the balcony. The lamps in the rigging loft are controlled by two three-point switches; one in the loft and the other near the stage switchboard. In the center of the rigging loft is placed an outlet for a stage chandelier. The bunch lamps are placed in a rectangular wood box covered with a sheet-iron reflector and provided with a telescopic iron stanchion. Each bunch light, of which there are four in use, is wired for 12 lamps. There are also in use 12 strip lights with receptacles spaced 1 ft. apart. Four of these strips are 12 ft. long, four are 8 ft. long, two are 6 ft. long and two are 4 ft. long.

In the front of the house there are a number of extra outlets provided. For cleaners' lamps, four outlets are provided on

FIG. 6.—PROMENADE IN REAR OF PARQUET CHAIRS.

each floor, and there are six portable stands, each fitted with a key socket and a plug for insertion in the receptacles. Twenty outlets are installed for use in connection with electric fans in the auditorium and 16 outlets are provided in dressing rooms for the same purpose. From the cut-out center controlling all the outside lamp circuits, four circuits of three No. 6 wires are run to three signs, one circuit not being connected at present.

Back of the stage switchboard in a fireproof compartment the dimmers for controlling all the lamps on the stage and in the auditorium are installed. The dimmers for controlling the house lamps are operated by a single lever and are rated for 400 16-cp lamps. For controlling the lamps on the stage, the following dimmers are installed: Eight dimmers for controlling the footlights; eight dimmers for controlling the border lamps; eight dimmers for the lamps in the proscenium, and two dimmers for the bunch lights. The levers for controlling the dimmers are placed in four rows, arranged to interlock in such a manner that any or all of them may be controlled by a master lever.

The bracket lamps around the main auditorium walls on the first floor, balcony and gallery are wired so that in addition to the control from the switchboard they may be controlled from the box office on Broad Street. One leg of the circuit connecting all emergency lamps is connected to both sets of buses and

the other leg of the circuit is connected to a tap on a common wire to the emergency switch and back to the neutral of the three-wire system, thus completing the circuit.

Fig. 2 is a view of the auditorium from the stage and shows the method of illuminating the various parts of the theater. The center chandelier is equipped with 96 outlets for lamps, and around the front of the balcony and the gallery are 18 and 20 two-lamp fixtures, respectively. The greater part of the illumination is received from two-lamp ceiling and bracket fixtures. The foyer is lighted by six-lamp ceiling fixtures, as shown in Fig. 6, and by a number of three-lamp bracket fixtures on the columns. The chandeliers in the lobby have 10 lamps each, and each of the arches is equipped with 12 lamps. The ornate pedestals shown along the railing of the incline are topped with one lamp in a round globe. The chandelier in the Sansom Street lobby is equipped with 12 lamps. The large electric sign on Broad Street with the name of the theater contains over 300 lamps.

The ventilation of the theater is accomplished by means of electrically-driven fans. The exhaust ventilation of the auditorium is taken care of by three disk exhaust fans, each with duct connections to vent registers at different ceiling levels, as owing to the extreme slope of the balcony and gallery floors, it was found desirable to exhaust the air from the ceiling spaces of each level. For simplicity, the three systems are operated independently, the air in the ceiling space under the balcony being exhausted by a 30-in. fan, that under the gallery by a 36-in. fan, and the air in the main ceiling space of the auditorium being exhausted at the rear by a 42-in. disk fan. These fans are located in wall openings into the open court on the stage-entrance side of the building. The fans are all of the multivane disk type, with special spider mountings for direct-motor drive. The fans were built by the American Blower Company, of Detroit, and are equipped with 1, 1½ and 2 hp Diehl direct-current motors, respectively. The motors are enclosed in substantial iron box enclosures, which are connected between the fan frame and the exhaust ducts to facilitate access to the motors. Located upon an enclosed steel platform over the stage entrance in an open court space is a 50-in. full-housed, steel-plate bower with a 30-in. wheel for supplying fresh air to the dressing rooms having no outside window openings. This fan is driven by a 3-hp motor. The toilet rooms are connected to an exhaust-air system equipped with 12- and 24-in. Blackman disk exhaust fans.

The feed pump for the boiler used for supplying steam to the heating system is driven by a 1-hp motor. In the basement are also installed a motor-driven vacuum cleaner, a motor-driven fire pump and motor-driven sewage ejectors. The various dressing rooms are also equipped with electric curling-iron heaters. The theater is the first to be built in Philadelphia under the new rules of the fire underwriters. The architects of the building were Marshall & Fox, of Chicago, Ill., and the electrical equipment was installed by the Malcolm W. Hill Company, of Philadelphia, Pa.

Wireless Telegraphy and Telephony.

At a recent Royal Society soiree in London, L. H. Walter exhibited a tantalum wire point dipping into mercury in a small bottle, as a good detector for wireless telegraphy and telephony and as particularly useful for the latter purpose. In reality Mr. Walter has found that this detector gives louder sounds than an electrolytic detector, which it emulates in other respects, at distances of 450 miles when less than 2 kw was being used. He also exhibited an electrolytic signaling key. It is an instrument for giving Morse signals on circuits using 2 kw or more without any sparking in the air, the current being broken under a solution of ammonium borate in an aluminum valve cell. There are two aluminum disk electrodes facing one another, and separated by a small gap; when the key is depressed, the two electrodes are pressed against one another, so that the current interruption following the next moment takes place across the gas film settling on the aluminum.

What Is Light?

BY P. G. NÚTTING.

The numerous recent modifications and improvements in sources of illumination are bringing into prominence the theoretical problem of the physical definition of light itself. Radiation is not light, nor is any selected portion of radiation even proportional to light, yet radiation is the only measurable objective factor in light. The question of how much light will be given by a source emitting a known amount of radiation of a given quality must be examined with great care.

Light has yet to be defined in precise mathematical terms. The word is applied both to the subjective sensation and to the objective stimulus, causing or capable of causing the sensation. Let us see how precisely and rationally each may be related to spectral energy in watts per unit wave length. We shall find that by far the simplest procedure is to treat the eye as a physical instrument of known sensibilities, seeking a relation between scale reading and the intensity and quality of the operative stimulus. As an instrument the eye is not unlike an alternating current ammeter whose sensibility passes through a pronounced maximum at a certain frequency, but of vastly greater range than any instrument ever devised.

Mention must be made of something that light is *not*, for the error is widely extended and firmly rooted. Twenty years ago, when spectral energy curves were first being studied, Langley divided the spectrum at wave length 0.70μ in order

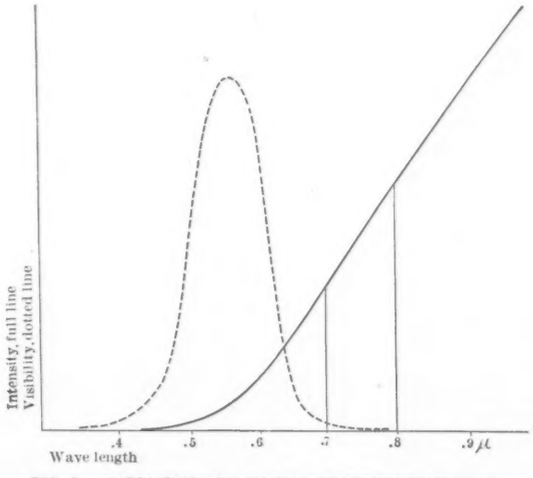


FIG. 1.—RADIATION AND VISUAL SENSIBILITY CURVES.

to obtain a purely numerical rough measure of luminous efficiency. He took as light that portion of the enclosed area on the short wave length side of the ordinate at 0.70μ. Langley's idea appears to have been that the amount of light lopped off beyond that wave length would about balance the defect due to loss of sensibility from 0.70μ in to the maximum, which is not far from correct for the intense flame source he used, but subsequent workers have erroneously taken the limiting ordinate as though it were the dividing line between visible and invisible radiation and have pushed it out to 0.76 or even 1.20μ.

How serious an error this assumption may lead to may be seen best perhaps from the curves in Fig. 1. The full curve represents the radiation from an ordinary carbon filament lamp at normal voltage, according to recent data supplied by Dr. Coblentz. Ordinates are drawn at 0.70μ and 0.80μ. It makes a difference of about 100 per cent in the area to the left, if we choose the latter in place of the former as limiting ordinate. The actual effect on the light of lopping off that part of the spectrum between 0.70μ and 0.80μ would, however, be hardly 1 per cent or 2 per cent at most. The dotted curve represents relative visual sensibility at an intensity of about 40 meter candles. Obviously the area is not even proportional to the actual light represented and can by no means be taken as a proper measure of the light. A better procedure would be to

give to each ordinate a weight according to the corresponding visibility of radiation.

Historically there is but little to be said. No one appears to have directly attacked the general problem. Goldhammer[1] has developed an expression for the relative chromatic sensibility of individual eyes which we shall mention later. Hertzsprung[2] has set up an approximate formula for intensity sensibility and made some ingenious applications of it. The writer gave a brief general outline of the problem in the *Physical Review* (February, 1907).

In order to express light (integral or spectral) in terms of radiation, we must know (1) the average relative sensibility of the human eye for the same amount of radiant energy at each wave length of the visible spectrum, and (2) the variation of sensibility with intensity at constant wave length. Then spectral energy multiplied by (1) is luminosity or objective light and this product operated on as indicated by (2), will give the subjective light.

Sufficient data is available for at least roughing out the solution and for directing the more precise determination of the essential constants. A pitiful amount of data is valueless because of failure either to record the spectral energy of the source used or else because two variations were covered at once. A long series of investigations by A. König, in conjunction with Brodhun, Dieterici and others, are free from these defects and his results are in such form that they may be easily recomputed for our purposes. The writer has determined experimentally some of the constants of the fundamental equations.

VISIBILITY AND OPTICAL INTENSITY.

Vision is apparently accomplished by the retinal rods alone from the threshold value (roughly 0.0003 m-c) up to about 0.1 m-c. From that intensity up to about 100 m-c, cone vision appears to play an increasing part in vision and above 100 m-c it is the chief factor.

For visibility at low intensity there are considerable data in fairly close agreement. The best is that of A. König[3] on nine different subjects given in the table below.

VISIBILITY AT LOW INTENSITY (ROD VISION.)

Wave length.	A. B.	E. H.	F. D.	R. R.	E. B.	A. K.	A. H.	E. K.	F. H.	X. P.
.430	.015	.10	.038	.062	.064	.059	.047	.069	.31	.089
.450	.074	.30	.14	.25	.21	.21	.23	.23	.47	.01
.470	.27	.64	.31	.50	.47	.49	.50	.49	.74	.58
.490	.57	.90	.58	.74	.80	.60	.86	.69	.96	.84
.505	..	1.00	.85	1.00	1.00	1.00	1.00	1.00	1.00	.99
.520	1.00	.96	1.00	.85	.98	.99	.98	.87	.90	1.00
.535	.78	.77	.85	.64	.74	.77	.75	.66	.71	.81
.555	.45	.47	.49	.33	.41	.42	.36	.38	.44	.47
.575	.20	.20	.25	.12	.17	.17	.12	.14	.21	.13
.590	.085	.076	.15	.051	.067	.061	.045	.071	.10	..
.605	.035	..	.09	.022	.026	.022	.015	.024	.048	..
λ max	.518	.507	.521	.504	.512	.511	.511	.506	.502	.514

This data plotted to maximum ordinate unity gave for the wave length of the maxima the data of the last line. Other

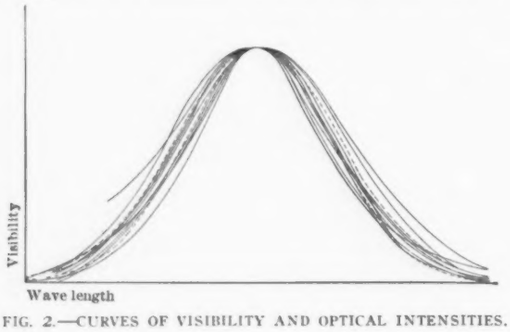


FIG. 2.—CURVES OF VISIBILITY AND OPTICAL INTENSITIES.

data by Pflüger (nine subjects) and Langley (four subjects), not produced here, give as a mean wave length of maximum sensibility 0.5097, which we shall take as 0.510 even.

Shifting the curves of König's data to 0.510 as maximum ordinate, the curves reproduced in Fig. 2 are obtained. They form a fairly symmetrical galaxy, so narrow that a mean curve may be drawn with some certainty. The well-known probability curve is of this form. To represent these visibility curves it may be written

$$V = V_{oc} - \kappa (\lambda - \lambda_m)^2$$

where $\lambda_m = 0.510$ and $\kappa = 530$ (computed mean).

Goldhammer (l. c.) used the function

$$\left(\frac{\lambda_m}{\lambda}\, e^{\,1 - \frac{\lambda_m}{\lambda}}\right)^n$$

to represent some of König's data, n varying from 150 to 300 with different individuals. This curve is always steeper on the

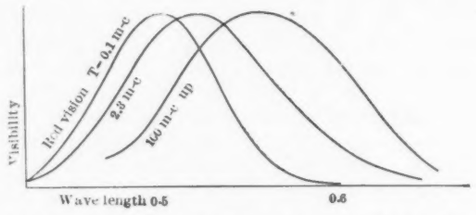


FIG. 3.—VARIATION OF VISIBILITY WITH INTENSITY.

blue side and represents the data scarcely as well as the simpler probability curve, but has the advantage of being integrable and of the same form as the Wien-Paschen emission function.

Numerical values are given below:

Wave Length.	Mean Observed.	Probability, $\kappa = 430$.	Goldhammer $n = 235$.
.410	.03	.02	.01
.430	.06	.07	.03
.450	.23	.22	.16
.470	.49	.51	.46
.490	.81	.84	.83
.510	1.00	1.00	1.00
.530	.81	.84	.86
.550	.49	.51	.54
.570	.22	.22	.27
.590	.08	.07	.11
.610	.03	.02	.03

The computed probability curve for $\kappa = 430$ lies nearer the mean observed curve than do most of the individual curves.

For moderate and high intensities the only data available are those of A. König on his own eye, but his eye was very near the average in sensibility and the work was carefully done. His method was to find by measuring slit widths the relative amounts of energy necessary to produce a constant illumination throughout the spectrum of a gas flame. The writer has taken König's equivalent slit widths, corrected them for the spectral energy of the source (which König fortunately determined) and plotted the reciprocals to maximum ordinate unity. The final corrected data is given in the following table and accompanying curves (Fig. 3 and 4):

ROD AND CONE VISION.

VISIBILITY AT VARIOUS INTENSITIES.

Intensities.	.00024	.00225	.036	.575	2.30	9.22	36.9	147.6	590.4 m-c
Ratio to Proceeding.	9.38		16	16	4	4	4	4	4
λ = .430	.047	.057	.076	.060	.063	.057	...	....	....
.450	.23	.21	.21	.20	.14	.10	.085	....	....
.470	.50	.46	.42	.42	.36	.19	.16	.13	....
.490	.85	.78	.75	.70	.63	.40	.28	.25	.24
.505	.99	.99	.98	.94	.88	.63	.50	.45	.40
.520	.97	.96	.94	.99	.97	.85	.72	.69	.67
.535	.75	.76	.76	.83	.98	.98	.91	.88	.87
.555	.36	.42	.47	.54	.83	.97	.99	.99	.99
.575	.12	.17	.20	.26	.58	.85	.97	.98	.98
.590	.045	.059	.095	.15	.42	.71	.88	.92	.92
.605	.015	.022	.044	.10	.28	.54	.71	.079	.79
.625	...	...	.022	.05	.17	.05	.42	.52	.54
.650	...	...	...	...	.057	.11	.15	.18	.23
.670	...	...	...	...	...	.038	.050	.055	.058
λ max	.511	.511	.511	.515	.529	.545	.560	.565	.565
Constant κ	461.	466.	445.	395.	254.	221.	214.	198.	197.
$V_o/13$ =	1.08	1.16	.94	.74	.31	.48	1.07	1.00	1.00

There is some doubt as to the exact value of König's light unit, but it was approximately one meter-candle (between 0.3 and 1.5 m-c). At the foot of the table are given the wave lengths (λ max.) of maximum sensibility at each intensity determined graphically, the mean computed value of the constant κ and the value of V_o under the assumption that objective light and radiation are proportional.

In Fig. 3 are reproduced three of these curves exhibiting the variation of visibility with intensity. The one to the left is

[1] D. A. Goldhammer, *Ann. d. Ph.*, 16, 621-652, 1905.
[2] Ejnar Hertzsprung, *Zeit. Wiss. Phot.*, 3, 468-472 and 4, 43-54, 1906.
[3] Helmholtz Festgruss, 309-388 (1891).

for the threshold value and will do quite well at all intensities up to about 0.1 m-c. It represents the chromatic sensibility of the retinal rods alone. The middle curve is for the intensity 2.30 m-c and shows the effect of cone vision beginning. The curve to the right is for intensities over 100 m-c and shows cone vision completely established.

In Fig. 4 are shown the variations of λ_m and κ plotted

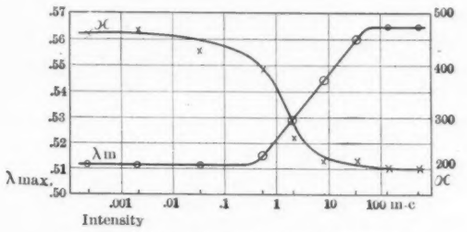


FIG. 4.—VARIATION OF WAVE LENGTHS.

against logarithmic intensity. The curve for λ_m is most remarkable in form and is independent of the assumption of any equation. Estimated probable errors are indicated by the diameters of the circles drawn about points of observation.

König's data gives only relative sensibility. The actual value of V_o in candles per watt must be determined at some high intensity by direct experiment. This has been done by the writer. The method was to measure the same monochromatic radiation as radiation and as light, with a thermopile and by comparison with a lamp of known candle-power, the thermopile being calibrated in watts/cm².

The corrected values are given below:

Wave length.	Watt cm².	Meter-candles.	Meter-candles, watt/cm².	Candles, watt.
.620	.000162	64	390,000	3.1
.566	.000042	64	1,520,000	12.1
.566	000036	61	1,700,000	13.5
.595	.000123	182	1,480,000	11.8.

These intensities are low to measure as energy and high for light, so that the determination is only approximate and the value 13 c/w used above (for $\lambda_m = 0.565$) is uncertain to perhaps 5 or 10 per cent.

So much for the eye as a constant deflection instrument and for objective light and what may be called the luminosity or optical intensity of radiation. We have next to consider the relation between scale reading and stimulus to arrive at a concept of subjective light and the actual visual intensity of radiation.

On the plan here outlined, it would be quite feasible to define the properties of an average standard eye for general adoption by means of which to translate radiation into light. The constants involved would require more precise determination, particularly in the intermediate range of intensity, but this could easily be done to within the limits of photometric precision and that would be sufficient.

PHOTOMETRIC SENSIBILITY AND VISUAL INTENSITY.

To obtain a relation between scale reading and stimulus; that is, between subjective light and radiation, recourse must

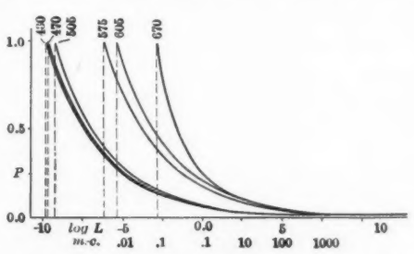


FIG. 5.—LEAST PERCEPTIBLE INCREMENT, P (L).

be had to an indirect method, for the magnitude of a light sensation cannot be directly measured or even estimated without a very large possible error.

Now, with any deflection instrument the derivative of the scale reading with respect to the deflecting stimulus is the sensibility of the instrument at any part of the scale or for any value of the stimulus. In the visual case we have the (photometric) sensibility given to find the scale reading (light sensation), so we integrate the curve of sensibility as a function of intensity.

The best data on photometric sensibility is that of König and Brodhun[4], an abridged table of which is given below:

PHOTOMETRIC SENSIBILITY.

λ =	.670	.605	.575	.505	.470	.430	white.
L_o =	0.060	0.0056	.0029	.00017	.00012	.00012	.00072
L			δL:L				
10,000	.0156	.0163	.0179	.0181	....	....	.0176
5,000	.0176	.0158	.0166	.0160	....	....	0.179
2,000	.0165	.0180	.0180	.0175	.0180	....	.0181
1,000	.0169	.0198	.0185	.0184	.0167	.0178	.0178
500	.0202	.0214	.0180	.0194	.0184	.0214	.0192
200	.0220	.0225	.0225	.0220	.0215	.0245	.0222
100	.0292	.0278	.0269	.0244	.0225	.0246	.0298
50	.0376	.0378	.0320	.0252	.0250	.0272	.0324
20	.0445	.0460	.0385	.0295	.0320	.0345	.0396
10	.0655	.0610	.0582	.0362	.0372	.0396	.0477
5	.0918	.103	.0888	.0488	.0464	.0494	.0593
2	.1710	.167	.136	.0655	.0715	.0600	.0939
1	.258	.212	.170	.0804	.0881	.0740	.123
0.5	.376	.276	.208	.0910	.096	.0966	.188
0.2	...	.332	.268	.110	.127	.116	.283
0.10	...	...	.396	.133	.138	.137	.377
0.05	...	...	...	.183	.185	.154	.484
0.02	...	...	...	.251	.209	.223	.695

They measured intensities downward at each wave length to avoid the Purkinje effect, so that the threshold value (L_o) given above in meter-candles was obtained as a fraction of a high intensity (about 300 m-c).

The corresponding curves are given in Fig. 5, extrapolated to $P = 1$ for $L = L_o$, since at the threshold value the least perceptible increment is the whole. These curves are of the well-known exponential type and may be closely represented by the function

$$P = P_m + (1 - P_m)\ (L_o/L)^n$$

Visual sensibility is proportional to $1/PL$, hence integrating this we have for the visual sensation

$$B = B_o \log\ (1 + P_m\ (L^n\ L_o{}^{-n} - 1))^{1/n}$$

The constant B_o depends upon the unit of sensibility chosen. The integration constant is zero, since at the threshold of vision ($L = L_o$) the sensation vanishes. $P_m = 0.016$ (Fechner's constant) the minimum relative least perceptible increment. The chromatic parameter n varies with wave length as follows:

Wave length...	.430	.470	.505	.575	.605	.670
Constant n.....	.323	.323	.335	.364	.388	.584

The argument of the function B (subjective light) may be identified with the luminosity (objective light) which is the product of radiation and visibility.

THE PURKINJE EFFECT.

The relations between light and radiation above developed give a quantitative measure of the Purkinje effect, the *bête noire* of photometricians. Its simplest statement is perhaps that the constant of proportionality between optical intensity and radiation varies with the wave length. Its complete description would require the complete establishment of the tempered light scale, for which we have neither the data nor the space at present. But for the total Purkinje effect between very high and very low intensities, we may easily obtain four widely different expressions.

1. Take the ratio of visibility ($\kappa = 200$, $\lambda_m = 0.565$) at very high to that at very low intensity ($\kappa = 460$, $\lambda_m = 0.511$), then the effect is

$$e^{-200\ (\lambda\ -\ .565)^2} \div e^{-.460\ (\lambda\ -\ 511)^2} = e^{+260\ (\lambda\ -\ .470)^2}$$

This would indicate that the effect is zero in the blue at 0.470μ, increases in the violet and green and very rapidly in the red. König found it zero in the blue.

2. From the visual sensation function $B(L)$, we have for proportionately, $P_m{}^{1/n} = \text{constant}$, where $P_m = 0.016$ and n varies with wave length as given above.

[4] *Sitz.* A. K. Wiss. Berlin, 917-933, 1888.

3. The threshold value measured (in m-c) down from a high intensity gives the total effect directly. Such values are given in the table of photometric sensibility.

4. From the corrected data on visibility in the second table the effect at four wave lengths may be roughly calculated by dividing the visibility at the highest intensity by that at the lowest. Numerical values obtained by all four methods are given below:

Wave length.	Total Purkinje Effect by Method			
	1	2	3	4
.430	1.52	1.00	1.00	...
.470	1.00	1.00	1.00	1.00
.505	1.37	1.57	1.42	1.73
.575	17.4	4.20	24.2	31.4
.605	144.0	8.46	46.7	203.0
.670	...	302.0	500.0	...

All four methods are based on small differences of uncertain quantities so that closer agreement could hardly be expected.

CONCLUSION.

The logical conclusion of such a paper as this would be the establishment of a complete tempered light-radiation scale covering all visible wave lengths and all intensities (0.00001 m-c to 1,000,000 m-c) for which the eye may be used. But even if space permitted, sufficient data of sufficient precision is not at present available to establish such a scale once for all. Still the way has been blocked out and the three fundamental relations developed with (it is believed) an uncertainty less than that due to varying observer and apparatus in the determination of data.

The photometric comparisons by different observers, of sources differing in color from the greenish white of the mantle to the reddish yellow of the glow lamp, can never be in satisfactory agreement with each other. The logical solution of this difficulty would be to adopt a general light scale based on the mean properties of the average eye so that each observer might correct his readings for departures of his eye from the standard.

Any attempt to construct a primary standard of light intensity must take into consideration the variation of visibility with intensity or else it will be subject to errors comparable with the numbers in the last table.

Bureau of Standards, Washington, D. C.

Faulting of Tantalum Lamp Filaments.

A thesis prepared by Mr. M. D. Abbott, of the University of Nebraska, gives the results of an investigation of the phenomenon of faulting of the filament of the tantalum lamp under direct, alternating and intermittent direct current.

The lamps used in these tests were of American make, rated at 20 cp and 110 volts. The measured diameter of the filament was 0.0017 in., with a tensile strength as obtained from tests made on two samples of 225,000 lb. per square inch, being thus much stronger than steel. The color was steel gray, with a metallic luster. The lamps were suspended from coil springs placed between two supports and connected, two in series, to 220-volt mains. The accompanying figures were drawn from observations of the filament taken under the microscope. Following are data relating to these figures:

Direct Current—A, 148 hours; *G*, 423 hours.

Intermittent Direct Current—B, 17 hours; *C*, 25 hours; *D*, 35 hours; *E*, 137 hours; *F*, 84 hours.

Alternating Current—H, 42 hours; *I*, 51 hours; *J*, 58 hours; *K*, 79 hours; *L*, 126 hours; *M*, 393 hours; *N*, 619 hours.

The tensile strength of the filament shown at *A*, tested under direct current, was found to be greatly reduced at the end of the run, and varied from 30,000 lb. to 60,000 lb. per square inch. The color had changed from a silver gray to a dull black, and slight depressions or creases are noticeable, as represented at *a*, which in some portions extended nearly across the surface. *G* shows the filament to be very ragged. Small waves or crests and hollows, as shown at *b b*, appear on parts of the surface. The filament is brittle, but strong enough, however, to withstand a moderate jar or shock. The color is very glossy black.

H, *I* and *J*, tested under alternating current, show plainly the faulting of the filament. Slight depressions or pittings are distributed throughout its length, as shown at *c*. The color

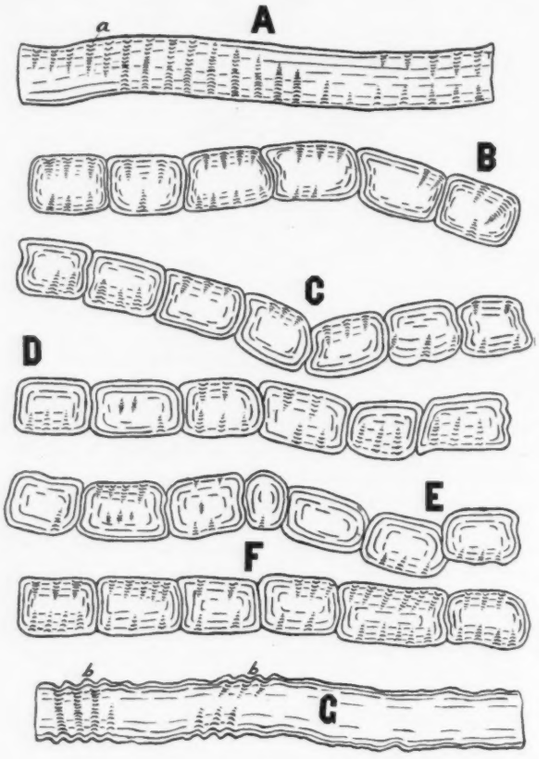


FIG. 1.—FAULTING OF TANTALUM LAMP FILAMENTS.

of *H* is glossy black. *K* and *L* exhibit phases of change in the filament. The color changed to a very glossy black. At

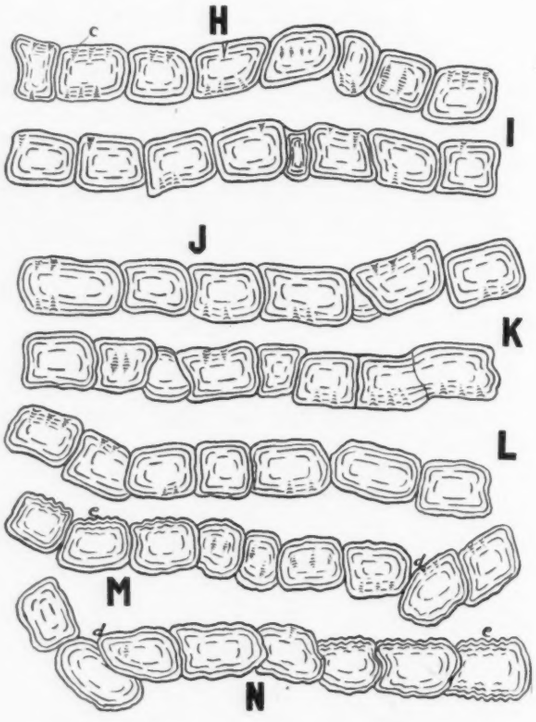


FIG. 2.—FAULTING OF TANTALUM LAMP FILAMENTS.

M and *N* is shown a marked deterioration of the filament at the joints, and as shown at the points *d, d*, the segments in some

places have slipped, so that only a small area is in contact. Small crests and hollows, as shown at *e, e,* appear on portions of the filament; color very glossy black. The filament in all cases when supplied with alternating current, even on short service, became very brittle and its strength so affected as to render it subject to injury from slight jars or shocks.

In the test with intermittent direct current, the current used, with the exception of *F,* was delivered from a commutating device which produced equal periods of on and off circuit, and the frequency was so adjusted that only a slight flicker was noticeable in the lamps. The voltage was regulated to give the same luminosity as when on alternating or direct current. Except for the absence of the crests or hollows observed in the alternating-current experiments, intermittent direct current produced results similar to the former. At *F* is shown the results of an intermittent service produced by a "skedoodle" socket. The faulting did not appear uniform throughout the length of the filament, as shown by the long segment on the right of *F.* Some portions showed an even greater length apparently not broken up, but by close inspection fine lines were noticeable running across the filament in a transverse direction, which indicated the beginning of a joint. The color was dull black.

Calibration of Watt-Hour Meters.

By Joseph B. Baker.

In the previous articles by the writer (May 30 and June 20) the various tests and examinations leading up to the actual recalibration of meters have been described in detail. The tests are made on the customer's premises with the meter in service. If a thorough overhauling shows that the meter will not have to be returned to the shop for repairs, the meter should be calibrated on both light-load and full-load, the necessary adjustments being made by the helper under the supervision of the tester.

In calibrating a commutator or induction meter the speed at full-load should be adjusted first, by shifting the position of the braking magnets toward or away from the shaft—toward the shaft to increase the speed, and away from it to decrease the speed.

In shifting the position of the magnets, as a rule it is only necessary to loosen one of the magnet screws, and the magnet can then be pried either way by wedging a strong screwdriver between the magnet and the meter frame, care being exercised not to press on the disk, as doing so would be apt to bend the disk or shaft, or damage the jewel bearing. The magnets should be kept as nearly as possible the same distance from the center of the disk, and should not be moved so as to lap more than ⅛ in. beyond the edge of the disk. Moving the magnets further would mean excessive leakage of lines of force, around the edge of the disk, which should pass through the disk. It is better to keep the magnets well within the edge of the disk; and if moving them out to the extreme limit mentioned is not sufficient to bring down the speed, stronger magnets must be installed, as it is probable that the magnets with which the meter is equipped have become weakened or demagnetized.

The speed at light load should then be adjusted; in commutator meters by shifting the position of the shunt field coil—toward the armature to increase the speed, and away from the armature to decrease the speed; and in induction meters by shifting the copper "shading strip" or "light load adjustment" one way or the other.

In making this adjustment time must be taken to note the tendency of continuous or intermittent vibration to start creeping in the meter or the effect of the friction of the moving system of the meter is diminished by vibration. On the other hand, it is desirable to watch the performance of a direct-current meter on light load for a period, after a thorough overhauling of commutator and brushes; i. e., during the time required for the commutator and brushes to attain their permanent condition of oxidation and wear—and follow up and compensate for any increased friction and resistance at the commutator by new adjustments of the shunt field coil.

The register is, of course, to be left on the meter, with the worm and worm wheel properly meshed, during the calibration. If after making the full-load adjustments it is found necessary to alter the light-load adjustment to any marked degree either way, the full-load speed should be checked again, and the magnets readjusted if necessary; bearing in mind that an adjustment of 10 per cent on light load—with the shunt field coil, or the "shading strip," as the case may be—affects the full load calibration about 1 per cent, while the magnet adjustment affects both the light-load and full-load calibrations equally; so that the general calibration of the meter for accuracy on both light load and full load may have to be effected by a process of approximation, as indicated.

The object of the various adjustments constituting the calibration of the meter is to attain 100 per cent of the accuracy of the indicating instruments taken as standard. Accordingly, the adjustments should be manipulated to make the meter accurate, on both loads, by comparison with the instrument readings; and they may then be altered further to leave the meter running a little fast (not over 2 per cent), as the tendency, especially in commutator meters, is always to run slow in time.

Tendency to creep should also be observed while the meter is being calibrated, thereby saving time, otherwise the meter may need to be recalibrated, owing to the adjustments made for creeping. Creeping may be obviated in commutator meters by attaching a small piece of iron to the moving system of the meter in such a position that the attraction exerted upon it by one of the brake magnets will check the motion of the disk on no load, when the piece of iron "comes around opposite the magnet," thus preventing the meter from creeping more than one revolution. A tiny staple-shaped piece of iron wire, such as an ordinary paper clip, which may be slipped on the edge of the disk, answers nicely. The adjustment is effected by cutting down the clip until the magnet which is nearest the edge of the disk will hold the disk from rotating on no load under the conditions of vibration to which the meter is ordinarily subjected. The piece of wire should clamp the edge of the disk firmly with no possibility of slipping. A fine adjustment may be obtained by cutting one end of the clip shorter than the other—keeping the longer end on the top of the disk. Another method is to solder to the shaft a short piece of iron wire, which may be bent out, away from the shaft, until it is sufficiently attracted by the nearest brake magnet.

This arrangement is considered by some meter men to be better than a clip on the edge of the disk, for the reason that it may be adjusted through a wide range, whereas the clip referred to tends to prevent the disk from starting on extremely light loads. Some meters have been put out by their makers with their shafts equipped with a piece of nickel wire, to prevent creeping, instead of iron wire. Either of these devices may be used with induction meters also, but in some modern induction meters creeping is prevented by making the disk with two holes diametrically opposite each other. The iron creep retarder of whatever kind should be so adjusted that the nearest magnet will just barely hold it when the meter is tapped lightly with the fingers (to simulate heavy vibration to which the meter might be exposed) and yet not prevent the meter from starting readily when a very light load—not exceeding one-twentieth of full load—is put on. If it is necessary to install a creep retarder and it is found that the magnets would have to be shifted so near the edge of the disk, in order to prevent creeping, that their jaws actually enclose the creep retarder clamped on the edge, the magnets should be replaced by stronger ones. Some companies make it a rule not to install creep retarders unless absolutely necessary.

If the meter creeps due to vibration, even with the friction compensating device moved into its least effective position—as it may be very apt to do just after being cleaned up or after having its jewel and pivot replaced—soft rubber washers

may be interposed between the meter and the wall or other support on which it is mounted, using two washers at each of the screws which secure the meter to the wall—one under the head of the screw and one between the lug of the meter and the wall. If the use of the rubber washers does not suffice, a creep retarder may have to be put in; or in case of very heavy vibration the meter should be placed in a more favorable location. Sometimes heavy vibration may be absorbed by placing the meter on a small shelf with three pieces of sponge rubber on the shelf under the meter, instead of screwing the meter to the wall.

Excessive vibration is a cause of serious trouble to commutator and brushes and to jewel bearings. It may be so intermittent as to escape observation and remedy by the meter inspector, and thereby become, unawares and between inspections, a cause of gross inaccuracy of the meter. Thus, it may start creeping, which will mean high meter readings; or it may roughen the jewel and pivot by the continual hammering action, or set up sparking at the commutator, either of which will mean low meter readings. Vibration is therefore one of the most unfavorable conditions of installation, and as such is to be avoided with the utmost care. When the local conditions are such that excessive vibration of the meter cannot be avoided, the tension of the brushes must be increased sufficiently to avoid all danger of sparking, and the condition of the jewel, the pivot or shaft-end and of the top bearing should be watched with care.

If a short circuit is made through the field coils of the meter after it has been calibrated, the meter should be tested once again, as these short circuits are apt to weaken the damping magnets in any event, and are practically certain to do so when the magnets are mounted parallel to the axis of the field coils as in the old-style meters. Even when the magnets are mounted at right angles to the axis of the field coils—the position in which they are least susceptible to demagnetization by strong stray fields—heavy short circuits will sometimes weaken them enough to make the meter run 50 per cent fast.

The resetting of the magnets of old-style meters by turning them through a right angle, so as to place the magnets across instead of parallel to the field flux, is a piece of work which usually requires the removal of the meter to the laboratory. However, when there are a large number of central-station meters installed, the resetting of the magnets at right angles may be done on the consumers' premises by removing the magnets and providing them with special bases, made up in the repair shops and drilled so as to support the magnets in the new position.

Before leaving the premises the tester should give the meter another general look-over to see that it is properly connected and that everything is shipshape before the cover is replaced and the meter sealed. Thus, the cover should be examined, and any foreign particles—scraps of insulation, wire, etc.—that may have been caught in the cover during the time it has been removed should be cleaned out before it is replaced on the meter.

After the meter has been made accurate in every respect, the tester should complete the filling out of the test card and disconnect and pack up the instruments.

The helper in the meantime can remove the temporary wires from the meter and put back the permanent wires belonging to the installation, making sure before leaving the premises that the consumer's circuit is alive. He must then turn the register back until the dials show the same reading as they did before the test—unless the consumer has been using energy during the test. In turning back the register it is not necessary to take it entirely off the frame; by simply loosening one of the screws, one end of the register may be pried away from the frame until the worm wheel comes clear of the worm, and then the register can be turned back to the original dial reading in a few seconds. After setting the register screws up tight again, the shaft should be given a spin to make sure that the worm meshes properly with the worm wheel on the register.

Metal meter covers should be examined for dents or for any deformation of the edge or gasket that will prevent them from fitting properly over the meter and closely enough around the base to be insect-, dirt- and moisture-proof. The glass windows should be well cleaned and secure in their fastenings, with no cracks or crevices in the putty between the glass and cover to admit moisture, dirt and insects. If a new glass has to be put in, all of the old putty should be removed and a tight joint made with fresh putty between the glass and the cover. It is well to wipe the cover carefully, inside and out, just before replacing it on the meter, and it should be held up to the light to see if any holes have been made in it through which wires, etc., may be inserted with malicious or fraudulent intent to interfere with the working of the meter.

Glass meter covers should be cleaned and polished inside and out, and examined for continuity and "life" of the sealing gasket.

If the magnets have been shifted in calibrating the meter, the helper should putty up the magnet screw holes again. Anything else that can be done to improve the general appearance of the meter and its surroundings should be done before the inspector leaves the premises. All remaining entries should be made on the test card, including the time of leaving the premises.

The Number of Lamps for Uniform Illumination.

By Alfred A. Wohlauer.

The area which can be uniformly illuminated by a single source of light of a given mean spherical candle-power depends only on the light emitted and on the illumination required. If

L_s = mean spherical candle-power of lamp,

I_o = the intensity or uniform illumination in foot-candles,

then the diameter of the circular area illuminated, in feet, is

$$d = 4\sqrt{\frac{L_s}{I_o}} \qquad (1)$$

the light absorption by the reflector being temporarily neglected. Equation (1) could be considered as recognizing the

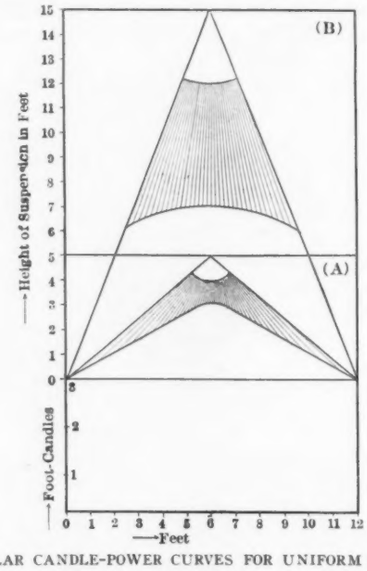


FIG. 1.—POLAR CANDLE-POWER CURVES FOR UNIFORM ILLUMINATION OF 3 FOOT-CANDLES BY SINGLE LAMP AT DIFFERENT HEIGHTS OF SUSPENSION.

absorption by the reflector if L_s is allowed to represent the mean spherical candle-power of the flux actually emitted by the reflector.

Equation (1), which does not contain the height of suspension, shows that the area which can be uniformly illuminated with a certain intensity by a single illuminant of a given mean spherical candle-power does not depend on the height of suspension. By using a proper reflector for each height the light of the illuminant is distributed so that at different heights

of suspension the same area is always uniformly illuminated with the same intensity. This relation is illustrated in Fig. 1, where a lamp of a given mean spherical candle-power ($L_s = 25$ candles) is suspended in one case (A) 5 ft. above the illuminated plane and in another (B) 15 ft., and a uniform illumination of an intensity of $I_o = 3$ foot-candles is desired. The reflectors used in the two cases differ, so that in each case the same circular area, 12 ft. in diameter, is uniformly illuminated.

There are, of course, certain practical limits reached in the design of concentrating as well as diffusing reflectors. For instance, it would not be practicable so to concentrate the light from an incandescent lamp that the latter could be placed on the top of a steeple in order to illuminate a certain area on the ground floor. Moreover, it is impossible so to diffuse the light that the lamp can be suspended only 1 in. above the plane which is to be illuminated. Without counting such extreme cases, the above equation gives the correct value for the diameter of a circular area uniformly illuminated by a single lamp equipped with proper reflector.

Larger areas necessitate a multitude of lamps, and the question arises as to the number of lamps required to illuminate a given area. Theoretically, the number of lamps depends only on the light emitted by each lamp, the intensity of illumination required and the area to be illuminated. If it were possible so to utilize the total flux of a certain number of lamps as to obtain ideal uniform illumination, no restriction would be necessary in practice. However, a single lamp, for instance, will always illuminate only a circular area, and a multitude of lamps, even when skilfully combined, will never lead to an absolutely uniform illumination. This effect can only be approached with more or less accuracy by the various methods of light distribution. Incidentally, the more the illumination approaches the ideal case of uniformity, the better the agreement with the theoretical number of lamps, as indicated below.

It would be possible, for instance, to place lamp units such as discussed above and illustrated by Fig. 1 at an equal height, at a distance D between each other ($D = d =$ diameter of the circular area which can be uniformly illuminated by a single lamp). They would uniformly illuminate tangent circular areas as indicated in Fig. 2. In this case uniform illumination would be obtained along the lines *ab, ae, ef,* etc., which connect the points of the plane just underneath the centers of the lamp. On the diagonals *af, eb,* etc., however, dark stretches occur, as no light is thrown on the shaded spaces of Fig. 2, which lie outside the boundaries of the uniformly illuminated areas. Such uniform illumination, with intermediate dark spots, would be permissible in places where (as in restaurants and the like) the tables or the objects to be illuminated

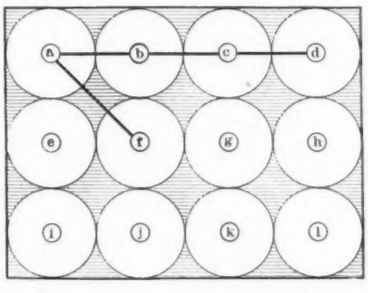


FIG. 2.—SPORADICAL UNIFORM ILLUMINATION.

could be so located as to be just within the limits of uniform illumination, while the dark spots fall in places which do not require the full share of illumination. For office buildings, auditoriums, department stores and the like, such an illumination would not be satisfactory, as it is not possible to predetermine the exact position of the objects to be illuminated, and non-illuminated spaces might prove very annoying.

If the light distribution of the lamps be so changed that the corresponding illumination curves are inclining and overlap each other, as suggested in former articles,* no dark spaces will be encountered and the unevenness will be kept down to a minimum. There will be points of maximum illumination; the non-uniformity, however, will be very slight and can be neglected in practice or overcome by certain modifications in the light distribution. (See Fig. 4.)

The distance between the lamps could then be calculated from the formula

$$D = K\sqrt{\frac{L_v}{I_o}} \qquad (2)$$

where

$$K = \frac{D}{H}$$

L_v = candle power of the lamp vertically, downward,
I_o = intensity of illumination in foot-candles,
H = minimum height of suspension, in feet.

Equation (2), which is generally applicable in all cases, could

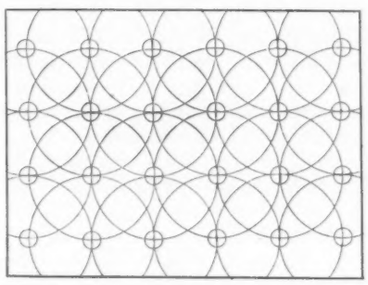


FIG. 3.—UNIFORM ILLUMINATION BY OVERLAPPING STRAIGHT ILLUMINATION CURVES.

be used also instead of equation (1), as can readily be recognized and demonstrated. There is a certain relation between L_v, K and L_s, the latter being the mean spherical candle-power of a lamp, as stated above, which can be expressed by the equation

$$K = \sqrt{\frac{a\,L_s}{L_v}} \qquad (4)$$

where a is a constant factor which depends on the method of light distribution and varies from 8 to 16, according to the

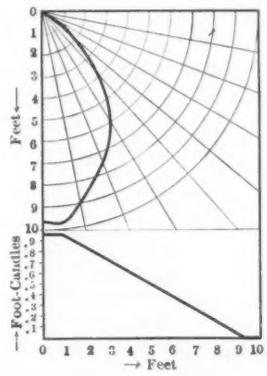


FIG. 4.—MODIFICATION OF ILLUMINATION CURVES.

shape of the polar candle-power curve of each lamp and to the location of the lamps. For instance, $K = \sqrt{\frac{16\,L_s}{L_v}}$ for the method of illumination discussed at the beginning of this article and represented by Figs. (1) and (2), and $K = \sqrt{\frac{8L_s}{L_v}}$ for the method illustrated by Fig. (3), and $K = \sqrt{\frac{9.7\,L_s}{L_v}}$ for the modification corresponding to the polar candle-power curve, as indicated by Fig. 4.

It is possible, however, to start directly from an equation for

*ELECTRICAL WORLD, Dec. 21, 1907. March 21, 1908.

the distance between the lamps, which would have the general form,

$$D = \sqrt{\frac{a L_s}{I_o}} \qquad (5)$$

wherein a has the same values as mentioned above. Equation (5) leads to the formulas $D = \sqrt{\frac{16 L_s}{I_o}}$ for "horizontal" illumination curves, $D = \sqrt{\frac{8 L_s}{I_o}}$ for "straight inclining" illumination curves and $D = \sqrt{\frac{9.7 L_s}{I_o}}$ for the modification.

Having determined the distance between the lamps, one can find the number of lamps required for the illumination of a certain area, S. Since $N = \frac{S}{D^2}$ the general form of the equation for detemining the number of lamps will be,

$$N = \frac{S I_o}{a L_s} \qquad (6)$$

Equation (6) enables one to ascertain the number of lamps of a certain mean spherical candle-power to illuminate a certain area with a chosen intensity of illumination. It will be recognized as a fundamental formula which can be used by the illuminating engineer in numerous cases.

It is obvious that, if there is no light absorption and the illumination is uniform, the number of lamps required would be

$$N = \frac{S I_o}{4 \pi L_s} \qquad (7)$$

which shows that the comparison of a with 4π, is a criterion for the uniformity of illumination as well as for the "efficiency" of the reflector. It is seen, furthermore, that if a equal 16, the uniform illumination cannot be complete, a conclusion indicating the dark spots discussed above and illustrated in Fig. 2. It is also evident that for a value of a of 9.7 corresponding to the modification illustrated in Fig. 4, the uniformity of illumination is much better.

Values of the Constant a for Various Reflectors and Lamp Distributions.

Reflector or lamp distribution.	Constant a.
Holophane reflector. Form C	4.3
Holophane reflector. Form D or S	5.
Holophane Pagoda reflector. No. 2510	8.
"Straight inclining" illumination curves	8.
Holophane bowl reflector. Form B	9.
Modification of "straight lines" illumination	9.7
National X-Ray reflector. No. 700	10.
Ideal uniform illumination. (4π)	12.5
"Sporadical" uniform illumination	16.

For practical calculations the factor a, which might be termed "constant of the reflector," must depend upon the loss of light due to the absorption in the reflector, a consideration which will modify the above theoretical values of a according to the "efficiency" of the reflector.

Equation (6) is correct only for methods of light distribution as discussed above, which are theoretical, at least up to the present time. However, it has a practical value in connection with existing reflectors and methods of light distribution if the proper value of a is introduced into the calculations. This value can be determined either experimentally or mathematically. The writer has attempted to ascertain the value of a for the various commercial reflectors utilizing data gathered together from trade publications. The results given in the accompanying table may convey a fair idea of the constants of the various reflectors. Additional practical investigations are necessary, however, to verify or correct them.

It should be stated that in the case of the practical and commercial reflectors, the values of a given in the table are fully correct only when the number of lamps utilized for illumination is rather high, so that all of the lamps participate in the illumination of the various points of the plane. For a very small number of lamps, the above values of a will not lead to such correct results, although the deviations are not very great. If, however, the polar candle-power curves of the lamps have the theoretical shape assumed above, so that one lamp does not throw its light beyond the foot of the next lamp, a much greater accuracy will be obtained.

New Telephone Patents.

TELEPHONE INSTRUMENTS AND ATTACHMENTS.

A telephone transmitter forms the subject of a patent granted to E. C. Corwin, of Clyde, Ill., this patent being assigned to the Corwin Telephone Manufacturing Company. The instrument follows in general design the standard solid back, but the mica auxiliary diaphragm has been replaced by a metal diaphragm and, therefore, the front electrode is in metallic contact with the frame of the instrument. On the other hand, the back electrode is insulated from the frame, as its adjusting stud slides within a collar, which is mounted upon the bridge in such a manner as to be entirely insulated from the latter.

Mr. W. W. Dean, of Elyria, Ohio, has patented a combined call register and transmitter. This is shown in Fig. 1. The transmitter casing is extended in a manner to cover the mechanism of a counter, which counter is mounted upon a base plate, secured in turn to the rear of the face plate of the transmitter. The advantage of this type of construction is that it is not evident to the user as to how the counter may be removed without dismantling the telephone to such an extent as to destroy its service. Furthermore, the mounting of the counter is such that

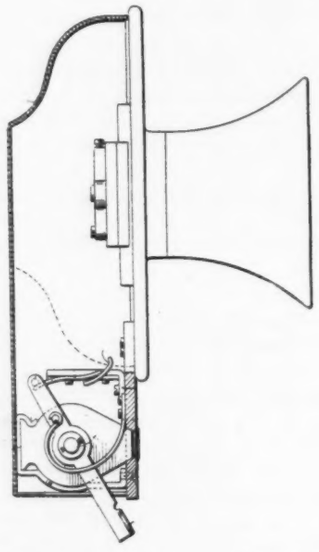


FIG. 1.—DEAN COMBINED REGISTER AND TRANSMITTER.

the operator should hear the signal read with maximum facility. Mr. Dean has assigned his patent to the Dean Electric Company.

Hard rubber, or imitations of it, have almost universally been used as the casing for telephone receivers and these materials have been found to have excellent qualities for this purpose. It has now been suggested, however, that glass or other vitreous material be used for the receiver casing, and W. Gibson, of Danbury, Conn., has patented a telephone receiver shell of this sort. He finds that, because of the difficulty in forming threads in vitreous material, it is advisable to form the receiver cap and the receiver shell, respectively, with metal rings at their contacting points. These rings are secured in position during manufacture and carry the threads by which the two parts are secured together.

Under the name of "Voice-Screen" there has been patented by R. H. Ralston, of Denver, an attachment for the mouthpiece of a transmitter adapted to so screen the mouthpiece that there is no escape of the voice to the surrounding air. This attachment is a sort of an oblong funnel-shaped affair, the front edge being curved so as to fit reasonably to the face of the user about the mouth. The small end of the funnel fits over the transmitter mouthpiece, carrying a soft gasket, which lies against the edge of the transmitter mouthpiece. An annular nut holds the funnel in place by being slipped over the small

end of the mouthpiece and drawn up until it comes in contact with the flare.

An antiseptic lining for telephone mouthpieces has been patented by H. Jankelowitz, of Germany. This lining is of the paper type, a pad of paper being formed up to fit the mouthpiece, this pad consisting of many layers and so perforated that the user can, at will, pull off the foremost, or outside, layer, exposing a fresh layer for his own use. The paper is so padded that a tab is exposed from each sheet so that this tab serves as a means of detaching the top layer.

RINGING KEY.

Fig. 2 shows a gang ringing key, patented by R. H. Manson, the patent being assigned to the Dean Electric Company. With all ringing keys it is necessary to perform two functions—first, to break the circuit toward the operator; and, second, to connect the ringing current. This gang ringing key is adapted to connect in one of four different kinds of ringing current and it is, therefore, provided with four plungers, each of which connects with its own kind of current. A single key, responsive to all plungers and located at the left-hand end of the group, as shown in the figure, serves to perform the cutting-off function. It will be seen that as any plunger is depressed the lower pin

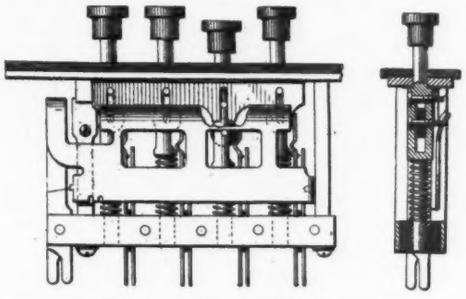


FIG. 2.—MANSON RINGING KEY.

in that plunger passes into a recess in the control plate, a portion of which latter is shown broken away. As the plunger is further depressed a second pin, the upper one in the plunger, presses against the slanting surface of the control plate and rocks this upon its pivots in a manner to operate the cut-off key. This occurs just before the roller of the particular plunger closes the contact of the ringing-circuit key. It will be seen that when the plunger is released, while both keys are restored, the plunger does not return to its normal position, because its lower pin locks in the recess of the control plate. This will indicate to the operator which key was pressed last. When it becomes necessary to depress a second plunger the rocking of the control plate releases the first plunger and permits its restoration to normal position.

MEASURED-SERVICE SYSTEM.

Mr. J. Harrison, of St. Louis, has obtained a patent for a system of call registering, the service meters being located at the subscribers' premises. The service meter is under the control of an electromagnet, which is included in the hook-switch circuits of the stations, so that it is impossible to operate any meter unless the hook-switch is raised—that is, in the position for conversation. The operator registers a count by applying to the line a special high-potential current by means of a key. A register signal is provided in the shape of a third lamp signal for each cord pair. This lamp signal glows only after the response of the called party, and it is permanently extinguished upon the pressing of the registering key. It seems probable at first sight that as the registering current can only be applied while the subscriber is talking, this considerable current impulse will produce disagreeable effects in his receiver in the form of a click.

ARRESTER.

William Kaisling, of Chicago, has patented an arrester unit for use with protector frames. He assembles his springs complete, adapted to hold both heat coil and carbon plates. These units may then be mounted on any desired framework without taking them apart. Mr. Kaisling has assigned his patent to F. V. Cook.

SWITCHBOARD-CIRCUIT SYSTEM.

A switchboard-circuit system of the two-wire common-battery type has been invented and patented by Mr. W. W. Dean, this patent being assigned to the Kellogg Switchboard & Supply Company. Two batteries are used—a calling and called-party battery—and the system requires a double-wound line relay and a cut-off relay. For the calling operation a current passes through the contacts of the cut-off relay, through one winding of the line relay (that associated with the tip side of the line) and then through the line and instrument, and to ground through the second winding of the line relay. This causes the line lamp to glow. When the operator responds the current flows through the tip and sleeve circuits of the jack in parallel. The current from the sleeve strand passes through the cut-off relay winding and through one winding of the line relay to ground. The tip-strand current supplies the instrument. The cut-off relay cuts from the circuit the line lamp to extinguish this, and, at the same time, opens the circuit of the tip side of the line relay.

TRANSMISSION CIRCUIT.

It has been generally recognized that with the ordinary telephone circuit one of the chief causes of attenuation of telephone currents is the shunting leakage between the two limbs of the line, due to mutual electrostatic capacity. Of recent years, however, a number of attempts have been made to use this leakage circuit as the direct transmission circuit. When such is the case one limb of the line is connected at the near end to the telephone set and is left open at the far end; similarly, the other end is connected at the far end with the distant telephone set and left open at the near end. The other side of the circuit is made up of ground or of a similar open limb. It will be seen that each wire serves as one plate of a condenser, the associated wire serving as the second plate of the condenser, with the result that the transmission circuit is akin to a condenser between the two telephones. It has been suggested that the longer the line and the higher the mutual capacity the better will be the transmission efficiency of the circuit.

With a view to improving this class of transmitting circuit by increasing the mutual capacity, Mr. F. Sindingchristensen, of New York City, has added condensers bridged between two associated limbs of a circuit. These condensers are placed at regular intervals and by their assistance, the mutual capacity may be increased to any desired amount.

PARTY LINE SYSTEM.

There has been patented by T. L. Willson, of Ottawa, Canada, a party line system, which requires several additional signal wires between the stations. The talking and selective ringing circuits are kept entirely distinct.

A selective lock-out step-by-step party line system forms the subject of a patent granted jointly to F. E. Mayberry, of West Medford, and N. H. Holland, of Brookline, Mass. In this system the ordinary ringing magnets serve, not only to operate the ringer, but also to control the step-by-step mechanism. A self-restoring ratchet is provided, which, except in the selective position, locks the switch-hook in a depressed position and also locks the ringing armature. In the selective position the stops are removed from the switch-hook and a nick in the ratchet disk registers with the ringer armature lug so that the latter may vibrate. Impulses of current of considerable duration operate the driving pawl, which rotates the ratchet disk at all stations, one step for each impulse. A retaining pawl holds the disk until a reversed impulse throws it out. A stop linkage is provided between the operating and retaining pawls so that when the alternating ringing current is applied to operate the ringer at the released station the operating pawl will respond in a manner to hold the retaining pawl against release.

For multi-party lines all sorts of devices and schemes have been developed to prevent the listening-in, and prevent the ringing of the bells, of non-wanted stations. These systems have, in general, been of two classes—the step-by-step, in which there

is located at each station a selective switching mechanism operated under the control of the exchange; and the selective, in which some special application of current selects immediately the desired station from all others.

In this latter class is the system patented by H. D. Williams, of Vermillion, Kan. His is what might be called a "limit system," for at each station are placed two control relays. One of these fails on too weak a current and the other operates on too strong a current. Either action cuts the station, both as to its signaling and talking circuits, from the line. The right current for any station operates the first relay and permits the second relay to fail. The currents applied by the operator are direct and the voltages are varied by considerable steps, so as to give as much margin to the relays as possible.

DESK STAND.

In Fig. 3 is shown an adjustable desk stand set, invented by W. B. Oliver, of Collingswood, N. J. The cut is almost self-explanatory. The stand is capable of horizontal rotation about a joint immediately above the base, while it is adjustable

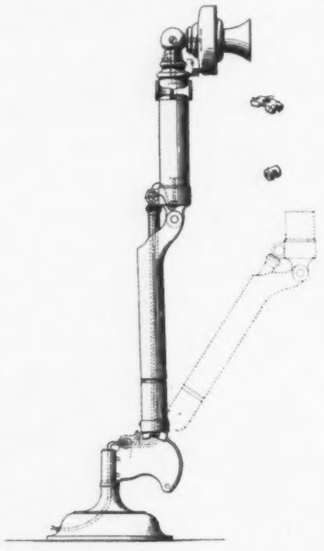


FIG. 3.—OLIVER ADJUSTABLE DESK STAND SET.

vertically through the parallel motion indicated by the dotted lines. A counter-balance spring is contained within the larger tube, so adjusted that the stand will remain in any position.

TRUNK CIRCUIT.

C. W. Sharer, of Philadelphia, has patented a trunk circuit which is designed to facilitate quick clearing of the called subscriber. A called subscriber's clearing-out signal and a guard signal enable the B, or trunk operator, to clear on the clearing-out signal, and the guard signal then warns the B operator against reassigning the trunk line until the calling end has been cleared. The circuits are adapted to the Dunbar type of two-wire switchboard. These patents have been assigned to the Keystone Telephone Company, of Philadelphia.

Letter to the Editors.

Testing Watt-Hour Meters.

To the Editors of Electrical World:

Sirs:—On page 1145 of your issue of May 30 there appears in an article by J. B. Baker on the "Preliminary Inspection and Testing of Watt-Hour Meters" the following paragraph: "Polyphase watt-hour meters are most conveniently tested as single-phase watt-hour meters by connecting the potential coils in multiple and the current coils in series, and dividing the calibrating constant by two. Either side of the meter may be tested separately, however, by connecting one potential coil only at a time and using the actual calibrating constant."

To the second sentence of this statement I would take exception, at least as applied to polyphase watt-hour meters of Westinghouse make. The calibration of these should always be made with both potential coils in parallel on the single-phase circuit on which the meter is being tested. It makes no difference whether one or both current elements are calibrated, but, in any event, the shunt coils should both be in circuit.

This matter was investigated in a recent test at the Newark works of the Westinghouse company in the presence of representatives of the company and of the electrical engineering department of Columbia University. The registration of a 200-amp polyphase watt-hour meter in percentage of true watts was found to vary as follows:

Both current coils and both potential coils in, 101.8; either current coil and both potential coils in, 101.8; upper current and upper potential coils only, 106.8; lower current and lower potential coils only, 104.0, thus indicating a tendency to increase the registration of the meter by an average of 3.6 per cent because of the absence of one of the two potential fluxes.

A. E. Seelig,
Test Officer, Electrical Engineering Department.
Columbia University, New York.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Generators, Motors and Transformers.

Single-Phase Motors.—P. Dawson.—Continuations of his very long illustrated serial on electric traction on railways. The author discusses the series motors of the Oerlikon Company, the Siemens-Schuckert Company and the General Electric Company, and the compensated-repulsion motor of Eichberg.—Lond. *Elec.*, May 22 and June 5.

Commutation.—The conclusion of the long polemic discussion between C. L. R. E. Menges and R. Goldschmidt concerning the fundamental principles of commutation in dynamo-electric machinery and the effects produced by the covering of armature slots.—Lond. *Elec.*, May 22.

Lamps and Lighting.

Tungsten Lamps.—H. Hirst.—A paper read before the (Brit.) Inst. Elec. Eng. on tungsten lamps. The author describes the two chief methods of making tungsten filaments, developed by the Welsbach Company and by Just and Hanaman, namely, the paste process and the coating process. Of all metals which have been experimented with up to the present, only pure tungsten has a life as high as 1000 hours when operated at about one watt per hefner candle-power. The following figures give a comparison between the electrical power taken and the light radiated from the surfaces of osram and carbon filaments. One sq. mm. surface of osram filament gives 0.5 cp, and consumes 0.55 watt; 1 sq. mm. surface of carbon filament gives 0.182 cp and consumes 0.63 watt. The osram filament consumes only 80 per cent of the power taken by an equal surface of the carbon filament, but gives 275 per cent of the light given by the carbon filament. "If the kind of radiation were the same in both cases, the carbon filament ought to get hotter than the osram filament by about 60 deg. C., because of the higher total radiation consumption per unit of surface. On the other hand, considering the greater light emanating from the osram filament, its temperature ought to exceed that of the carbon filament by about 200 deg. C. These contradictory conclusions show clearly how different is the radiating power of the osram filament as compared with the carbon filament. The

latter behaves much more like the 'black body' of the radiation theory." From approximate calculations the temperature of an osram filament consuming 1.1 watts per candle-power is about 250 deg. C. higher than that of a carbon filament using 3.5 watts per candle-power. "If a carbon filament were to be overrun to such an extent as to consume only 1.1 watts per candle-power, its temperature would then have to be raised by 360 deg. C. The favorable radiating properties of the osram filament, therefore, mean that its temperature is 100 deg. lower than that of a carbon filament of the same specific consumption. If it were not possessed of this radiating property it would have to be operated at a consumption of 1.5 to 1.6 watts per candle-power, in order that it might have the same life it actually possesses at 1.1 watts per candle-power." If one takes the resistance of carbon, tantalum, osmium and tungsten filaments at ordinary temperatures, the resistances at those temperatures which, in a vacuum, correspond to 1.5 watts per candle, will be as follows: For a carbon filament, 0.55 times of the original; for tantalum, 5.70 times; for osmium, 8.50 times; for tungsten, 11.00 times. Near the normal conditions the light of a carbon-filament lamp rises and falls with the 6.3 power, that of a tungsten-filament lamp with the 3.6 power, of the voltage. The author then discusses the use of tungsten lamps in series; for instance, pairs of 110-volt lamps on a 220-volt circuit. For testing tungsten lamps to be used for such purposes elaborate arrangements have been made. The lamps are tested to one-hundredth of an ampere, and sorted out in from five to seven series numbers according to the type of lamp and carefully marked, and the reference numbers (ranging from, say, 28 to 38, which are marked on the caps of all lamps, singled out for series burning) practically mean that the consumption of current is 0.28, 0.29, 0.30, 0.31, etc., ampere. Considerable data in form of tables and curves are given on life tests. Data are also given on the losses in transformers supplying energy to 25-volt metallic-filament lamps. Finally, a comparison of the cost of tungsten lamps and carbon lamps is given. The author considers the annual costs of an installation of 16-cp, 25-volt lamps, of which 19 are lighted at one time; the price of energy being assumed to be 8 cents per kw-hour. The adjoining table gives the cost of 16-watt osram lamps versus 60-watt carbon lamps:

Number of hours per year of load.	Osram lamps.		Carbon lamps.		Total.		Saving with Osram lamps.	
	Energy.	Lamp renewals.	Energy.	Lamp renewals.	Osram lamps.	Carbon lamps.	Total.	Per cent.
300.....	$10.95	$7.30	$27.74	$1.72	$18.25	$29.46	$11.21	38
400.....	13.44	9.73	36.99	2.31	23.17	39.30	16.13	41
500.....	15.88	12.16	46.23	2.88	28.04	49.11	21.07	43
600.....	18.30	14.60	55.49	3.22	32.90	58.71	25.81	44
700.....	20.80	17.03	64.72	4.03	37.83	68.75	30.92	45
800.....	23.24	19.47	73.97	4.62	42.71	78.59	35.88	45½

In the discussion which followed, H. Harrison said that incandescent gas mantles decrease 20 per cent in candle-power after 100 hours' burning, and 40 to 50 per cent after 500 hours, whereas tungsten lamps decrease only 10 per cent in candle-power after 1000 hours. He also pointed out that enclosed arc lamps consume nearer 2 than 1 watt per candle, and are, therefore, less economical than osram lamps, and that street lighting with osram lamps may be even cheaper than with open arc lamps, if the cost of carbons be taken into account. Drake mentioned the breakage trouble, to which, he said, tantalum lamps are less subject. Dr. Louis Bell said that the shorter life of the tantalum lamp on alternating-current circuits is due to the frequency of heating and cooling. In America, tungsten lamps are largely replacing enclosed arc lamps. The American standard ratings are now 100, 60 and 40 watt. Handcock pointed to the higher ratio of the mean horizontal to the mean spherical candle-power in the case of metal-filament lamps, and thought that comparisons on the basis of horizontal candle-power are, therefore, rather unfair to the carbon lamps in which the ratio is less. C. C. Paterson said that he did not understand why the new lamps should not be standardized in candle-power instead of in watts. His experience with the gas mantle differed from that of Harrison; he found that the candle-power rises largely during the first 100 hours or so and then drops. He does not attach importance to the difference between the ratios of mean horizontal and mean spherical candle-power in the carbon and metallic-filament lamps. It amounts to no more than 5 or 6 per cent; the reduction factor is 0.85 or 0.86 on the one hand against 0.7 to 0.8 on the other. T. H. Lowden said that the British Westinghouse Company is now selling a 220-volt, 32-cp lamp.—Hirst's paper in Lond. *Elec.*, May 22, 29, and in Lond. *Elec. Eng'ing*, May 28; an account of the discussion which followed in Lond. *Elec. Eng'ing*, May 28, and in Lond. *Elec.*, June 5.

Street Lighting in London.—A. A. VOYSEY.—A report on the best method of lighting the main streets of London, with diagrams showing the results of tests made in various streets. The illumination on a horizontal surface 4 ft. from the ground is assumed to be a sufficient indication of the useful light in a street, and the minimum value of such illumination is thought to be the most important factor in good lighting; this minimum should not be less than one-tenth of one foot-candle. According to the tests of the author such an illumination can be approximately obtained by 11-amp flame arc lamps with yellow-flame electrodes, spaced approximately, either on posts at the side at 20½ ft., or centrally hung, at 28 ft. from the ground. A more even distribution of light and a more economical result can be secured by the centrally-suspended lamp at 28 ft. than by the lamp at 20½ ft. on a post at the side. Economy requires the treatment of main streets and side streets together. It is recommended that demonstration should be made in the side streets of centrally-hung arc lamps as soon as possible. The author concludes that about $30,000 a year may be saved and a doubling of the average illumination throughout the city streets effected by using flame-arc lamps, assisted by a few metallic-filament lamps at places where arc lamps have not a sufficient area for economical lighting. Flame arc lamps are cheaper than high-pressure gas lamps. Where central suspension is used, it should be without lowering gear in broad streets, and with lowering gear in narrow streets. Any new standards which may be required should be designed according to the advice of some reliable guide. Finally, it is suggested that the question of reducing the lighting in the main streets after midnight should be taken into consideration.—Lond. *Elec.*, June 5; *Elec. Eng'ing*, June 4.

Metallic-Filament Lamps for Street Lighting in England.—Notes on results obtained in various English towns with osram lamps for street lighting. In Croydon 82 posts are equipped with osram lamps. Each post has two 104-volt, 35-watt lamps in series on the 200 to 208-volt alternating-current circuit. The average number of burning hours obtained per pair of osram lamps has been nearly 1300, but this is without taking account of lamps still running, which may bring the average well over 1500. There is no appreciable diminution of candle-power throughout the life of these lamps. The running cost with one pair of 35-watt lamps per post is as follows:

70 watts, 3,800 hours, 270 kw-hours at 2½ cents per kw-hour.....	$6.85
Lamp renewals (average 1500 hours per pair), 2½ pairs per annum...	2.31
	$9.16

In Exeter (which was the first English city to use osram lamps for street lighting, the beginning being made in 1906) there are now about 500 lamps in all, of which 135 are 110-watt lamps, mostly on trolley standards, and the rest 55-watt lamps on brackets on the old gas-lamp posts. Some of the lamps have shown exceedingly long life, ranging to above 4000 hours, but the average of some 1400 of them so far is about 1200 hours. A good deal depends on insuring that the e.m.f. is not too high.—Lond. *Elec. Eng'ing*, May 21.

Incandescent Lamps.—Continuations of the long illustrated serial on recent improvements in construction of incandescent lamps. An account is given of the proposal of Bastian and Calvert to use copper ribbon instead of platinum for leading-in wires. Then the methods of supporting the long metallic filaments are discussed to prevent the different loops from touching each other or the glass walls. Metallic supports cannot be used directly, since the process of exhaustion according to Malignani with phosphorus vapor would result in the formation of phosphides with a low melting point so that the supports would soon be destroyed. They are therefore now made of metals

covered with a film of a very refractory oxide. Several methods of applying this oxide layer are described. The author then passes to a description of the different forms of frames for supporting and holding the filament in position.—*Zeit. f. Beleucht.*, May 20 and 30.

Arc and Brush Discharge.—M. Toepler.—In the fixation of atmospheric nitrogen use is made of arcs several centimeters in length with a relative low current, and arrangements are made by which the gas is constantly renewed. In this way an accumulation of vapor emitted from the electrodes is avoided. In such experiments it is found that the middle part of the arc, which is free from the vapors of the electrodes, has an appearance very similar to a brush discharge. The author thinks that a long arc consists of two different parts, first, the zones near the electrodes filled with vapors from the electrodes, and second, the part removed from the electrodes, free from vapors and with a discharge of the character of the brush. Grau recently determined the relation between voltage, ampere and arc lengths for long direct-current arcs between artificially-cooled electrodes. The author shows that these measurements may be approximately represented by the formula characteristic for the brush discharge.—*Phys. Zeit.*, June 1.

Generation, Transmission and Distribution.

Overload of Generating Sets.—An account of a discussion on this subject held at the Newcastle section of the (Brit.) Inst. Elec. Eng. C. Turnbull thinks that "full-load might be defined as the point where the most economical load is exceeded by, say, 10 per cent. Overload is beyond this. Combined plant must give at least the specified power." "The maximum over-

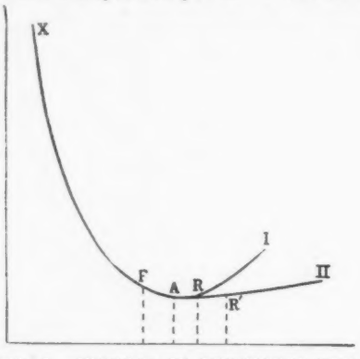


FIG. 1.—OVERLOAD OF GENERATING SETS.

load of the plant should be the maximum overload of the engine, the generator being made to suit. The generator should also be capable of running continuously at any load which the engine would carry economically." G. G. Stoney in criticising these recommendations referred to the different behavior of reciprocating and turbine sets, with reference to Fig. 9, where *I* is the curve for the reciprocating engine and *II* the curve for the turbine. According to Turnbull's definition, full load is located at point *R* 10 per cent beyond point *A*, the most economical point on the curve *XAR* for the reciprocating engine. In the turbine set nominal full load is usually taken at point *F* on the curve XAR^1, the 1¼ load being located at the point *A*, and the 1½ load at the point R^1. In a reciprocating engine, the consumption rapidly ascends again after it has reached its lowest point, while in the turbine the curve continues practically horizontal. Moreover, the turbine, if it runs five minutes under overload, will run equally well for 500 hours. The point can be put this way: "An alternator has a time-limit but not a load-limit, while the turbine has a load-limit but not a time-limit, and the proper combination of a turbo-alternator depends on the balancing of these relations." The best specification is generally one which requires a 5 per cent voltage regulation at full load, and an overload of 25 per cent, to the point where bypassing becomes necessary, with ability for 50 per cent overload when the bypass is opened. Reference was also made in the discussion to the importance of designing the switchboard so as to be capable of handling an overload.—Lond. *Elec. Eng'ing.*

Traction.

Electric Traction in Bavaria.—An article illustrated by diagrams and tables on the projected electrification of the state railways of Bavaria, water power to be utilized for the generation of the electrical energy. The average daily consumption when all lines are worked by electric traction would be 1,435,000 kw-hours, while, taking into consideration the various losses, the equivalent hp-hours at the turbines would be 3,400,000 and the mean daily load 142,000 hp. Moreover, it is estimated that the mean load due to the railways in 1920 will be 202,000 hp and the maximum load 606,000 hp. The minimum power available from water in Bavaria at any time is 300,000 hp, but with the aid of storage arrangements the falls are sufficient to supply all the energy required for traction. It is concluded that traction with motor cars or with heavy locomotives will be technically possible. Under present conditions the single-phase system is considered to best fulfill all requirements. Electric traction offers distinct advantages under all circumstances, namely, increased speed and avoidance of smoke nuisance. The additional question, whether the adoption of electric traction offers advantages over steam working, both in technical and financial directions, is answered by the fact that electric traction is financially on equal terms if (a) the cost of electrical energy does not exceed a certain limit, and (b) there is a certain density of traffic. These conditions are better fulfilled by the lines in southern than by those in northern Bavaria, as in the south coal is dearer, and electrical energy cheaper, on account of the available waterfalls power, than in the north. It is thought that the adoption of electric traction on the lines Salzburg-Bad Reichenhall-Berchtesgaden and from Garmisch-Partenkirchen to Scharnitz will be very advantageous financially. For the former railway it is estimated that steam traction and electric traction will be financially on equal terms if the cost of the kw-hour is 1 cent. The following procedure should be followed on all sections, except the first experimental lines: Lines or groups of lines should first be selected which, owing to their proximity to waterfalls and to their traffic requirements are especially suitable for electric traction. On the remaining lines electrical traction will, according to circumstances, not be adopted for some considerable time, as certain waterfalls may be more advantageously put to other uses, though their possible eventual employment for railway work will not be lost sight of.—Lond. *Elec.*, May 29.

Electric Railway for Postal Work.—The German postoffice authorities are considering the question of connecting the general postoffice in Berlin with the various stations by means of a special underground railway. A short experimental length of track from the postoffice to a railway station will first be built. The tunnels, which will be built directly under the road surface, will be 6 ft. wide by 2½ ft. high. The railway will be double-track throughout, and will have a gage of 1 ft. 4 in. Between the tracks a pit will be provided, allowing an inspection of the track to be made and repairs to be carried out. The "driverless" trains will consist of an electric locomotive drawing four cars, each containing a large sack of letters. The running speed will be 25 miles per hour, and will be independent of load, curves and gradients. The headway will be 90 seconds. Above each track will be placed two "third-rails," which will be about 1 ft. 6 in. from the track in the tunnels and 6 ft. 6 in. in the postal buildings, the trolleys being 6 ft. 9 in. long. The locomotives and cars are of the two-axle type, the former being equipped with two motors. For working this railway low-tension three-phase currents will be used.—From *Blätter f. Post u. Tel.*, abstracted in Lond. *Elec.*, May 22.

Installations, Systems and Appliances.

Losses in Alternating-Current Systems.—An illustrated description of the Berry "series systems," the object of which is to reduce the light-load losses in an alternating-current network, to only a small fraction of their former value. The fundamental principle is the use in each substation of a small auxiliary transformer, arranged with its primary and secondary windings in series with the corresponding windings of the main

transformer or bank of transformers, and connected with an automatic switch of special design, so that the small auxiliary transformer is short-circuited whenever the load rises above a predetermined limit corresponding to full load on the small transformer. Similarly the switch is arranged to remove the short-circuit and place the auxiliary transformer in circuit again as soon as the load falls once more below the fixed limit. Whenever the transformers are connected in series, nearly full pressure will exist across the ends of the windings of the small transformer owing to its impedance, while the large transformer will be practically idle, so that the light-load losses will be practically only those of the small transformer. Thus, if a 10-kw transformer is placed in series with a 100-kw trans-

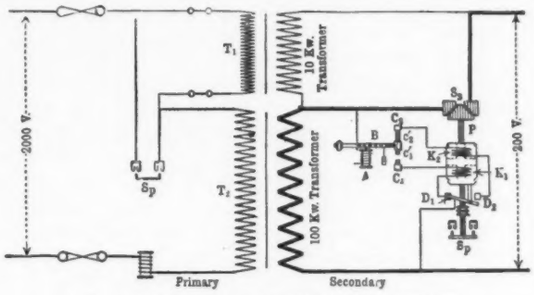


FIG. 2.—DIAGRAM OF SWITCH CONNECTIONS.

former across 2000-volt mains, the small transformer absorbs about 1900 volts, giving, say, 190 volts at its secondary terminals, while the large one absorbs the remaining 100 volts and gives 10 volts on its low-tension side. That is to say, the total losses with no load on the secondary side will be practically only one-tenth of those which would result from placing the 100-kw transformer directly across the 2000-volt mains. The diagram, Fig. 2, shows in a simplified form the arrangement of transformers and automatic switch for such a 2000-200-volt single-phase system. A 10-kw transformer, T_1, is shown in series with one for 100 kw, T_2, the switches S_p and S_s serving to short-circuit the former whenever the load rises above 10 kw. With the switches open, as in the illustration, the windings K_1 and K_2 of the switch will carry no current. On the load increasing above 10 kw the relay A, which is shown on both the primary and secondary sides, slowly pulls over the winding K_1 of the switch. This winding serves to lift up the plunger P, thus closing switches S_p and S_s, at the same time, by means of a rocking lever, breaking the circuit of K_1 at contact D_1 and closing contact D_2, so that, as soon as the circuit in the relay A decreases again, contacts $C_2C'_2$ are closed, current passes through coil K_2 and switches S_p and S_s are opened. Further advantages of the system are as follows: Considerably improved voltage regulation can be obtained, since, as the loads on the various substations increase, the larger transformers with higher voltages at their terminals come into operation. In this way the pressure is maintained at its correct value at

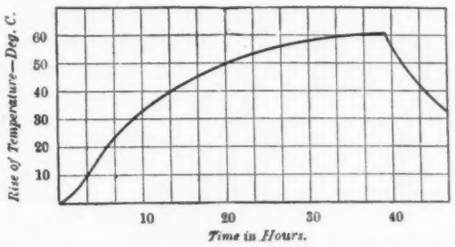


FIG. 3.—TEST OF 450-KW TRANSFORMER.

different parts of the network which may be unequally loaded. A more important point, however, is in connection with the design of the large transformers. These, owing to the smaller importance of the iron losses, can be designed to have small copper losses, which are thus at times of heavy load less serious than is usually the case, with consequently improved voltage regulation, also aided by the fact that the main transformer will be practically cool when coming into operation. That is to say, a transformer intended to be operated on the series system would be designed with larger iron losses than usual, although its efficiency at full load would be the same on account of the smaller copper losses. Also as these latter increase as the square of the current, it is obvious that the efficiency of such a transformer would differ at other loads from one of the usual design where the copper and iron losses are made about equal at three-quarter full load. Fig. 3 shows the results of an actual test on a 450-kw Berry transformer. It will be seen that, even with full load maintained continuously, the transformer requires about 48 hours to attain a steady temperature. But since the main transformers are practically out of operation for the greater part of every 24 hours, it is best to build them much smaller than is usually the case, probably to the extent of 25 per cent. Further, as a transformer cools down every day it is always in its most efficient condition when it comes into operation. The advantages claimed for the system are summed up as follows: "The light load iron losses of transformers connected may be reduced by from 70 to 90 per cent. The transformer copper losses at full load may be reduced by nearly 40 per cent. The pressure regulation at consumers' terminals is improved, with consequently increased energy sold. The life is increased and the rate of depreciation is diminished, since the main transformers are relieved of pressure for the greater portion of every 24 hours. It is possible, owing to reduction of light-load output, to use a motor-generator in connection with a battery, and so improve the load factor on the supply-station plant. The capital outlay on transformers is smaller.—Lond. *Elec.*, May 29.

Lightning Protection.—C. P. STEINMETZ.—The principal difference between lightning, in its broadest sense, and the normal flow of energy in an electric circuit is, that lightning is the phenomenon of electric energy when beyond control. This may mean either excessive currents or excessive voltages. Excessive currents are dangerous only when lasting for some time and can generally be taken care of by circuit-breakers, automatic cut-outs, etc. Excessive voltages on the other hand are practically instantaneous in their action. Dangerously high pressures may enter the electric circuit from the outside, due to atmospheric disturbances, such as lightning, or they may originate in the circuit. Atmospheric disturbances give either single or multiple strokes, and are sufficiently well taken care of by the modern multi-gap lightning arrester. Continuous discharges, or recurrent surges, that is, lightning lasting continuously for long periods of time, with thousands of high-voltage peaks per second, mainly originate in the circuits due to an arcing ground, spark discharges over broken insulators, faults in cables, etc. They require a lightning arrester which can discharge continuously without self-destruction, at least for a considerable time. The only lightning arrester which is capable of doing this is the electrolytic aluminum arrester.—The same issue contains a note by V. E. Goodwin on the care and inspection of lightning arresters.—*Gen. Elec. Rev.*, June.

British Central Station.—An abstract of last year's financial report of the Leeds municipal electric station. The number of kw-hours sold was 12,412,861. The working expenses per kw-hour sold were 1.34 cents; the total cost, including capital charges, 4.12 cents. The average price obtained per kw-hour was 4.38 cents. An interesting item in the costs is "wages incurred on extensions, but not chargeable to capital account, being paid to corporation's permanent workmen, 0.04 cent per kw-hour." A 3000-kw steam turbo-alternator has been installed at the generating station during the year, and the present rating of the plant is 12,740 kw. An additional turbine set rated at 3000 kw is on order, and expected to be available for use before next winter. The maximum load upon the plant has been 8300 kw, compared with 7470 kw in the preceding year.—Lond. *Elec. Eng'ing*, May 21.

Storage-Battery Installations.—An account of some changes in recent German practice with storage-battery installations in central stations. Boosters are now used exclusively for charging. While balancers had been erected in some of the larger stations in the nineties, they were hardly ever used, but they

are now coming into use extensively. Automatic operation of cell switches also meets with constantly increasing favor. Auxiliary cells are also made use of. Finally it is recommended to cover the cells during their use with glass plates in order to prevent evaporation and keep the obnoxious vapors out of the room.—*Elek. Zeit.*, May 21.

Protective Relays.—M. C. Rypinski.—In the conclusion of his long illustrated serial on protective relays he discusses several types of auxiliary relays. The first relay described may be used where a definite time-element action has not been provided for. It is adjustable only as to time-element and serves as an auxiliary relay to close the tripping circuit a definite length of time after its own actuating circuit has closed. It is chiefly used in connection with an instantaneous overload-relay. Another auxiliary type described is a bell relay which serves to indicate when a circuit breaker has operated by energizing a gong circuit and maintaining this circuit until it is opened by the switchboard attendant.—*Elec. Jour.*, June.

Circuit-Breakers.—H. G. MacDonald.—A continuation of his long illustrated article on circuit-interrupting devices, describing detail features of oil circuit-breakers, and especially the construction of the contacts, insulation and the operating mechanism, by means of which the contacts are opened and closed.—*Elec. Jour.*, June.

Station Connections.—R. E. Argersinger.—A discussion of some factors affecting station connections and switching arrangements. The author discusses single and multiple-bus arrangements and emphasizes that as any double bus is expensive, the actual need of it should be carefully considered before it is installed. The character of the automatic control is also an important feature which should be carefully considered.—*Gen. Elec. Rev.*, June.

Wires, Wiring and Conduits.

Submarine Cable.—An illustrated note on a large submarine cable to be used as a feeder on the Sydney trolley system and to be laid across Sydney Harbor. It is an "extra-high-tension" cable, and each core has a section of 0.062 sq. in. The cores are insulated with paper and covered with lead in the usual way. Above the lead is a layer of jute to serve as a bedding for the armoring, which consists of two layers of No. 10 S. W. G. galvanized iron wire. Over the armoring is a protective layer of jute. The heavy armoring is to prevent damage by ships' anchors and from other causes. To obviate the necessity of making joints in the cable, it has been supplied in one length of 2400 ft.; it weighs no less than 15 tons.—Lond. *Elec. Eng'ing*, May 21.

Electrophysics and Magnetism.

Electric Conductivity in Solids.—J. Koenigsberger and K. Schilling.—The author has determined the change of electric conductivity of silicon, titanium and zirconium between —180 deg. C. and + 200 deg. C. It was found that Ohm's law is fulfilled and no polarization (at least above 0.0001 volt) could be found; in other words, these elements are metallic conductors. According to the electronic theory these elements should therefore show a change of sign in the temperature coefficient of the conductivity at a certain temperature, and a minimum value of the resistivity. This minimum value was found to exist at —100 deg. C. for zirconium, at + 150 deg. C. for titanium, at + 800 deg. C. for silicon and at + 1800 deg. for graphite. Experiments were also made with magnetite which was also shown to be a metallic conductor, and to have a minimum point of resistivity. On the other hand, barium sulphate crystals were found to show a constant polarization of 1.49 volts against gold electrodes, so that they must be assumed to be electrolytic conductors.—*Phys. Zeit.*, May 15.

Photo-Electric Effect.—At a recent Royal Society soiree in London, Prof. J. A. Fleming demonstrated the well-known photo-electric effect (discovered by Elster and Geitel), shown by alkali metals, and particularly by the liquid potassium-sodium alloy, when sealed in vacuum tubes; they permit the escape of negative, but not of positive, electricity when illuminated by an arc lamp. The light was so directed that it fell on the surface of the alloy, a piece of platinum foil, the other electrode being fixed about a centimeter above the alloy; an e.m.f. of 0.8 volt was set up. When the illuminated alloy was joined to the negative pole of a battery, negative electricity leaked away, and this leak, it was shown by the interposition of colored screens, was produced chiefly by the most refrangible rays of the blue end of the spectrum; the magnitude of the effect further changed with the plane of polarization. Professor Fleming also demonstrated an observation, first made by him in 1904, that the carbon filament of a glow-lamp, having an insulated metal cylinder surrounding the filament, emits negative electricity, and can serve as a delicate long-distance receiver in wireless telegraphy. These oscillation receivers have been used in transatlantic telegraphy and also in radiotelephony.—Lond. *Eng'ing*, May 15.

Theory of Magnetism.—Pierre Weiss.—The author refers to Langevin's kinetic theory of paramagnetism and diamagnetism. It is assumed that the magnetic moments of the molecules are the resultants of the magnetic moments of the circular paths of all electrons in the atom. Two cases must be distinguished. In the first case the resulting moment is zero on account of the symmetric structure of the atom. In this case the only effect of an external magnetic field is a small deformation of the paths of the electrodes, which causes diamagnetism. In the second case the resulting magnetic moment is different from zero and the external field produces a torque on the molecules. On this basis, together with the kinetic theory of heat, it is possible to formulate a fundamental law for paramagnetism. Magnetization is the result of a static equilibrium between the external magnetic field and the thermal vibrations in the molecules. In order to give to paramagnetic substances, magnetic field intensities of the order of magnitude of ferromagnetic metals, flux densities of the order of 10^7 gauss would be required, which we are unable to produce. Langevin thinks that only the mutual action between the molecules is able to produce such high densities. The present author shows that by means of a simple hypothesis concerning the mutual action between the molecules Langevin's theory can be extended to the phenomena of ferromagnetism. He assumes that each molecule is acted upon by the other molecules in the neighborhood with a force equal to that of a homogeneous field proportional to and equally directed with the magnetic field density. Various conclusions drawn on this assumption are shown to correspond with the facts.—*Phys. Zeit.*, June 1.

Potential Variation in Atmosphere.—D. Smirnow.—A discussion of the different factors which influence the daily variation of the potential gradient in the atmosphere. There are three chief factors. First, during the night the atmosphere next to the earth is cooled and the diminution of its electric conductance causes an accumulation of positive charges on the earth's surface, therefore a decrease of the field above. In the morning when the earth's surface gets warmer the field intensity assumes again its former value. Secondly, in summer days the rising currents of air carry positive charges upward and leave an excess of negative charges (dust) behind so that the field intensity decreases in the lower layers of the atmosphere. The immediate action of the radiation from the sun is the production of negative charges in the highest layers of the atmosphere; a diminution of the positive charges in the middle layers of the atmosphere, and a diminution of the potential gradient near the earth's surface. This last factor is not clearly manifest in the daily variation, but manifests itself strongly in the yearly variation.—*Phys. Zeit.*, May 15.

Atmospheric Radio-Activity.—H. M. Dadourian.—An account of an investigation on the radio-active constituents in atmospheric air. The quantity of radium emanation in atmospheric air at New Haven, Conn., is from 30,000 to 50,000 times the quantity of thorium emanation; in Rome, Italy, the radium emanation is from 20,000 to 30,000 times the thorium emanation.—*Phys. Zeit.*, May 15.

Electrochemistry and Batteries.

Electric Steel.—R. H. Wolff.—A communication giving in a table the composition of steel made in regular commercial

operation during one month in the Héroult furnace in a French works. The various possibilities of electric steel refining under the present condition of the steel industry are pointed out, with special reference to steel castings. It is thought that the equipment of modern iron and steel works with gas engines will result in such cheap energy that the electric furnace will become an auxiliary apparatus in most steel works.—*Elec. and Met. Ind.*, June.

Copper Refining.—J. B. C. KERSHAW.—A review of the present condition of the copper refining industry. It is estimated that $75,000,000 are invested in this industry. There are 36 refineries in the world and three in course of erection. In the American refineries 86 per cent of the total output of the electrolytically refined copper is produced. Some notes are given on new plants in Australia and Russia.—Lond. *Elec.*, June 5.

Carbon Cells.—A note on a recent patent of Jungner for a gas cell in which the caloric energy of the reaction $SO_4 + O + H_2O = H_2SO_4$ is converted into electrical energy. If the sulphuric acid obtained by the above reaction is changed back into sulphurous acid by means of carbon, the whole result of the process is the oxidation of carbon to carbon dioxide. The various attempts which have been made to devise a carbon cell or to utilize in some other way the energy of oxidation of carbon to a greater extent than by burning carbon are reviewed in an editorial.—*Elec. and Met. Ind.*, June.

Units, Measurements and Instruments.

Voltameter.—R. A. LEHFELDT.—An account of his attempts to design a gas "coulometer." The usual trouble with gas voltameters is that they cannot be used accurately with high-current densities. In the instrument described by the present author the two electrodes are held in a cork, which can be inserted into a sort of inverted test-tube. The test-tube has a side limb for pouring in electrolyte till the platinum electrodes are well covered, and a small-bore gas tube runs from the top of the test-tube to a manometer and a gas-measuring apparatus. The manometer is a U-tube containing olive oil, one limb being open to the atmosphere. The gas-measuring apparatus is a vessel out of which mercury can be run from a tap at the bottom. In making a measurement of a quantity of electricity, the mercury was adjusted till the oil manometer showed that atmospheric pressure existed inside the apparatus, the circuit was closed, and mercury was run out to keep the oil manometer level. By weighing the mercury the volume of gas evolved could be estimated accurately. The temperature was kept as steady as possible by a water-jacket. The author used currents of about 0.6 amp and passed quantities of the order of a thousand coulombs through the apparatus. The mercury that was run out during an experiment averaged between two and three thousand grams. The author tried a great many electrolytes at this current density, using a potentiometer and standard-cell method of measuring the current. He found that many electrolytes give volumes of gas varying from 33 per cent to 99 per cent of the theoretical yield; but if solutions of sodium sulphate, of a concentration of 10 to 30 per cent, or solutions of potassium bichromate, of a concentration of 5 to 10 per cent, be electrolyzed, almost theoretical yields are obtained. With these solutions the apparatus is reliable and rapid, the error being within one-tenth per cent.—*Phil. Mag.*, May; abstracted in Lond. *Elec. Eng'ing*, May 21.

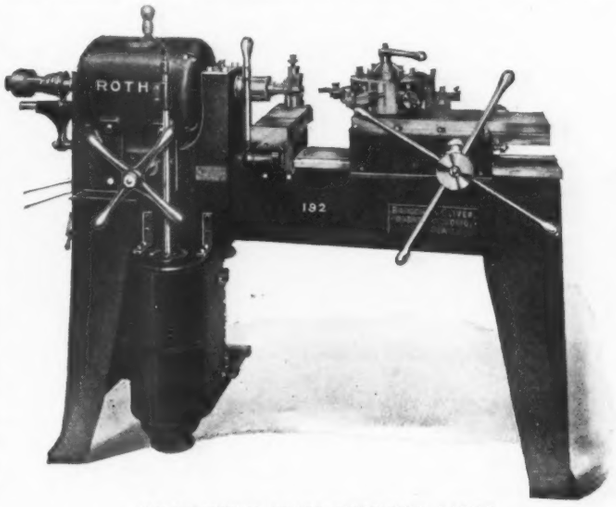
Hand Chain Hoist.

Climax Hoist Company, Philadelphia, Pa., is placing on the market a new spur-gear chain block designed by Mr. Burr, engineer of the company, which is particularly applicable for use in power houses for the handling of heavy weights. In the new hoist the load is carried on hardened and ground steel rollers. All gears are enclosed in a dustproof case and run in oil. The retaining brake is of the company's own design, and is noiseless in operation and positive in action. All parts are jig-made to standard sizes and are interchangeable. The load chain runs in a sprocket keyed to a long hub supported in a housing cast in one piece with an internal load gear. This gear is driven by a one-piece spur pinion carried on a stud with an internal gear driven in turn by a spur pinion carried on the hand-chain wheel shaft. The hand-chain wheel shaft is passed through the hub of the load gear to the opposite end of the block where the hand-chain wheel is located. Hoisting is accomplished by pulling on the right-hand side of the hand chain and lowered by pulling on the left-hand side, which releases the friction brake.

Motor-Driven Lathe for Brass Work.

The accompanying illustration shows a Bardon & Oliver motor-driven brass-finishing lathe in which the motor is mounted directly on the spindle and takes the place of the cone pulley. The armature is mounted on a sleeve into which the regular spindle of the lathe is pressed. The frame is supported on substantial brackets. The lathe bearing, hollow spindle and all other operative features of the lathe are maintained, the motor not interfering in any way with the regular performance. The rating of the motor in this case is 2½ hp, with overload capacity of 7½ hp. The speed is varied in 20 steps by means of the controller, from 300 to 1400 r.p.m. in either direction of rotation. The controller, which is of the reversible drum type with dynamic brake and mechanical dashpot, is mounted as shown below the bed of the lathe at the head stock and where it is out of the way. The shaft is extended to take a crank located conveniently for the operator.

A feature of this outfit is that various speeds in either direction of rotation can be obtained instantly. It is claimed that the controller handle can be thrown to any position or fully reversed as quickly as the handle can be removed without causing excessive rushes of current or sparking. The



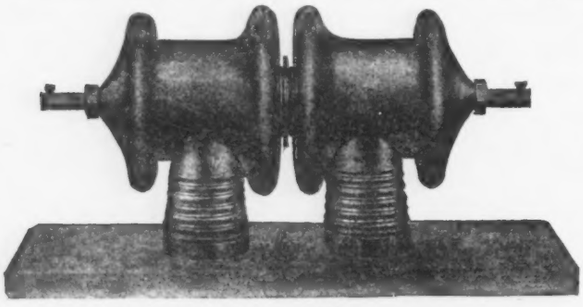
MOTOR-DRIVEN BRASS-FINISHING LATHE.

maximum current taken when the motor is thrown from highest speed in one direction to highest speed in the other is said to be 60 per cent in excess of the full-load current. The dynamic brake is a valuable feature in that the lathe is stopped instantly when the controller is moved to the off position, thus saving a great deal of the time normally required to bring the spindle to rest. To facilitate truing the work up in chucking, dead points are provided on each side of the dynamic brake. With the controller in this position the spindle runs freely.

The superiority of the method of mounting the motor directly on the lathe spindle is due to the rapidity with which the motor is able to respond to the action of the controller. The absence of gearing, belting, etc., makes the outfit noiseless. The amount of energy consumed is claimed to be almost exactly proportioned to the work, there being no extra bearings, gears, belts or other machinery to operate. The motors are manufactured by Roth Brothers & Company, of Chicago, and may be fitted to either new or old lathes of standard makes.

Abnormal Potential and Static Discharge Protector.

The device shown herewith, made by the Lord Electric Company, New York, has been designed to protect dynamos, motors, regulators and other similar apparatus from static discharges. It is connected to the terminals of the various machines or devices and offers a path over or around the machine by which a discharge may be delivered to any one of the grounded lightning arresters and there be dissipated to earth. It is a great

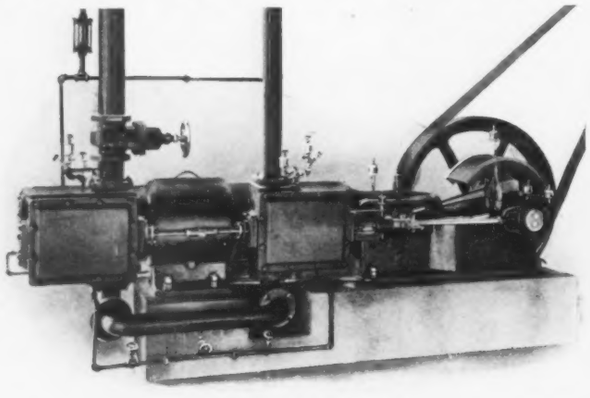


HIGH-POTENTIAL DISCHARGE PROTECTOR.

protection to weak insulation, relieving the windings of transformers, regulators, motors, etc., from excessive stress. When used in connection with lightning arresters it is of inestimable value. Used in substations, power houses and transformer houses it gives excellent results. It is of the general Shaw design, but involves other principles not employed in the regular standard lightning arrester.

Belt-Driven Pump for Obtaining High Vacua.

The accompanying illustration shows a belt-driven vacuum pump which is especially designed for laboratory use in the manufacture of incandescent lamps, etc. The illustration was made from a photograph taken of such a pump located in the plant of the Westinghouse Electric Lamp Company at Watsessing, N. J. The pump, which is of the two-stage pattern,



BELT-DRIVEN VACUUM PUMP.

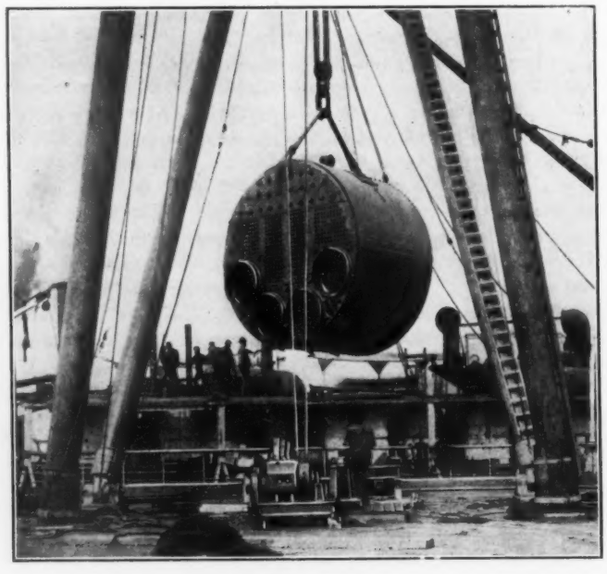
arranged with two 12-in. diameter vacuum cylinders, 12-in. stroke, and is designed for a speed of 100 r.p.m., will, it is claimed, produce a vacuum of within 0.02 in. of the barometric height as registered by the mercury gage. The suction is connected to a closed receiver which is piped off to the stands containing the incandescent lamps to be exhausted. The pump works strictly on the dry system and is adapted for all usages where high vacuum is desirable, as in connection with the evaporative processes of sugar refineries, distilling plants, chemical and dye works, glue works, salt works, soap works, the manufacture of prepared foods, medicines, essence, glycerine, etc., preserving processes, the production of high vacuum in central steam condensing systems and steam turbine work. The pumps are also built with steam cylinders for direct steam drive, or are arranged with extended bases and gearing for electric motor. The vacuum cylinders are water jacketed and the valves are mechanically operated by eccentrics keyed to the main shaft. Experience with work where a vacuum is required has shown that better results are obtained by means of two air cylinders; that is, in two stages, one cylinder discharging into the other. This machine is manufactured in various sizes by the Blake & Knowles Steam Pump Works, 115 Broadway, New York.

Electric Dock Hoist.

A striking example of time saving through the use of a modern electric hoist comes from the Pacific Coast, where in the yards of the Commercial Boiler Works, at Seattle, a 65-ton boiler was raised from the dock and placed in position in the hold of the steamship *Pennsylvania* in the short space of 20 minutes. The illustration shows the boiler about to be placed in the hold.

The plant of the Commercial Boiler Works, engaged in the manufacture of marine boilers and in handling ship repairs, has its machines equipped with individual motor drive, and to facilitate the loading of heavy materials it was found necessary to install electricity in the yards as well. The hoist used was supplied by the Lambert Hoisting Engine Company and is driven by a 40-hp Westinghouse direct-current motor, the speed of which is regulated by a drum-type controller, affording nine forward and nine reverse speeds. From the drums of the hoist a ¾-in. steel cable runs to the top of the shear legs, where it reeves through a set of blocks capable of lifting from 75 to 90 tons.

The boiler, which was lifted and placed in position in 20 minutes, was one of the largest ever built in Seattle. The worm-



ELECTRIC DOCK HOIST.

gear hoist which was previously used would have required three hours' time to raise the same load. A 15-ton boiler was recently loaded by the Lambert hoist in 4½ minutes.

The energy which drives the hoist and the motors in the shop as well is purchased from the Seattle-Tacoma Power Company, being transmitted by a two-phase line at 2300 volts. It is utilized on the dock as direct current and in the shops as alternating current for two 50-hp motors driving heavy rolls, one 50-hp motor driving an air compressor and various small motors, all of standard Westinghouse manufacture. A motor-generator set is installed in the shop, to supply the necessary direct current for the hoist.

Exhibits at Convention of Canadian Electrical Association.

Owing to the fact that it was not until a late hour that the management committee was able to secure the use of the University Chemistry and Mining Building, the exhibitors at the Canadian Electrical Convention, held at Toronto, June 17-19, were somewhat militated against. There was no large hall available, and the exhibits had to be separated. Thus the spectacular effects, which are always a feature of electrical displays, were lacking, and a comparison of the various arc and flame lamps shown in working competition was impossible. Some of the exhibits were in the hall and others in separate rooms down stairs, but in spite of these drawbacks the various firms made a creditable showing, and they were rendered every possible assistance by the University authorities, who placed all their electrical apparatus at their disposal.

THE CANADIAN GENERAL ELECTRIC COMPANY, of Toronto and Peterboro, whose stand was in charge of Mr. H. O. Edwards, was the largest exhibitor. Varied applications of electricity in many fields were shown, and particularly those calculated to interest small users of power. The domestic line was well covered, and included cooking utensils of every description, fireplaces, ovens, heating pads, pressing irons and water diffusers. Motors of small size were very much in evidence. One, a three-phase motor on a single-phase current, drove a little portable twist drill, and another a breast drill, while nearby stood a sewing machine with a motor attached. For owners of automobiles and motor boats there was a large choice of ignition apparatus, various lines of batteries and accumulators, as well as types of searchlights. For the benefit of the automobilist, living at a distance from a garage, there was exhibited a mercury-arc rectifier, for the transformation of alternating into direct current. A two-ton Sprague electric hoist occupied one corner of the room, and an electric saddle horse, full of surprises for the most accomplished rider, stood in another corner. The company showed a flaming arc lamp stripped to exhibit the working apparatus, and various meters, including a curve-drawing voltmeter, wattmeter for home use, and a prepayment meter, which is a new thing in Canada. The whole display was beautifully illuminated by tungsten lamps.

THE GAS & ELECTRIC POWER COMPANY, of Toronto, exhibited a large line of switches, meters and lamps. Its switches struck the observer as being of liberal proportions in the way of contact, area and brake. These features were embodied in the current and potential transformers for instrument use. The firm also showed some high-tension oil switches, with automatic release; meter transformers for use in conjunction with trip coils of oil switch; and alternating and direct-current meters fitted with cyclometer dials. The meters are for very low starting current, and the firm claims for them great accuracy, independent of wave form, periodicity and voltage variation. The company also exhibited a "Midget" arc lamp 15 in. x 4 in. A flame arc lamp was also shown of simple and durable mechanism, using either white, yellow or red carbons. Messrs. H. F. Dodd, D. O. Hills and J. C. Monahan were in charge.

THE CANADIAN WESTINGHOUSE COMPANY, of Hamilton, devoted the principal part of its exhibit to the lighting interests, and showed a very complete line of lamps in operation. Included were the new tungsten lamps, standard incandescents of various candle-power, Cooper Hewitt lamps, alternating series lamps and a new metallic flame arc lamp. There were various small transformers for small central stations, a number of small power motors and a washing machine operated by a motor. The firm showed an electrolytic lightning arrester outfit, with all accessories, oil switches and a number of direct and alternating-current wattmeters, both single-phase and polyphase, precision wattmeters and portable wattmeters. An exhibit of the Nernst lamp was in charge of A. E. Fleming and M. H. Smith, while the other exhibits were under the superintendence of W. H. Eisenbeis, W. W. Lovell and H. T. Gibbs.

JOYNER-GREEN, a new firm in the Canadian electrical field, which covers central station and power electrical equipment and electrical contractors' supplies, had an interesting exhibit. Mr. A. H. W. Joyner, who was electrical engineer for the Boston Edison Company, and afterward with Stone & Webster, had charge of the first department, while Mr. E. A. Greene, who obtained experience in the contracting and supply line in the West, looked after the second department. Their exhibit included the Helios arc lamp, twin carbon, 220 volts, and a Helios "Continental" arc lamp using 97 volts at the arc on a 110-volt circuit. They also showed Standard direct and alternating-current arc lamps, which are claimed to be absolutely noiseless, a "Dim-A-Lite" lamp, three voltages, new to Canada, and a miniature 3½-amp lamp burning 50 hours. Two other exhibits which attracted attention were an Anderson time switch with a specially-made clock, which is claimed to regulate the appliance to a second; and a cartridge coil, which can be taken to pieces, for portable engines. In the railway material line the firm showed strong, and also in some side lines. The exhibit was illuminated by a nightmare twirler flashing red and green lights alternately.

J. F. B. VANDELEUR, of the Dineen Building, Toronto, was in charge of an exhibit entirely British, which showed the characteristic of plain, thorough workmanship, compactness and strength. The Evershed & Vignole's "Meggers" for measuring insulation came in for much attention. Those shown were the variable-pressure "Megger" and the constant-pressure "Megger." In the former the generator is driven by a winch-handle and the volts at its terminal vary with the speed at which the handle is turned. In the constant-pressure type the generator is driven by a centrifugal friction clutch which secures the result that when the handle is turned over the slipping speed, the speed of the generator and the terminal pressure remain constant. A "Bridgeman Megger" to measure both conductor and insulator resistance was also shown. Other exhibits were a portable voltmeter and ammeter, and a 1000-amp shunt which was compactness itself, being only 5 in. x 4 in. x 2 in. There was a Gilbert constant-current transformer in which the working current is altered or adjusted by changing the position of the transformer. The current can be changed from 5 to 20 amp, and the instrument can be used in connection with street lighting, and may be placed in any chamber or substation. Near the transformer stood Gilbert arc lamps, both flame and enclosed, with covers specially designed against snow; and a 6-ft. carbon lamp designed to run from 50 to 70 hours. Another lighting device was a short lantern to be used in stoke-holes on board ship. In connection with navy-yard work was exhibited one of Berry's patent switch and fuse gears, claimed to be capable of standing a dead short circuit simultaneously across both poles at 550 volts pressure without arcing. Another noteworthy marine device shown was an Evershed & Vignole's stoking indicator in use on many of the British warships. One indicator is placed in each stoke-hold and indicates at regular intervals, by numbers, which furnace requires fuel. Other naval exhibits were, a fire-control apparatus which transmits orders from the conning tower to the guns in each position. The signals include the range and the deflection "right" or "left"; a danger indicator shows when guns in different positions are bearing upon each other, so that one may shoot away the other's muzzle for example; a helm indicator automatically indicating the position of the rudder in a battleship. These last three instruments are in use in both British and Japanese navies. Mr. Vandeleur also exhibited Morgan's pneumatic brush gear, and Morganite brushes. These are constructed in layers rendering the resistance across the brush seven to eight times greater than in the other direction, while the highest conductivity line is into the external circuit, and the highest resistance is offered to currents in the short-circuited coil. A sample of enameled insulated wire lay near the brushes.

THE CANADIAN FAIRBANKS-MORSE COMPANY exhibited several types of its smaller motors and exhaust fans.

Other exhibitors were the Electrical Specialties Limited, showing dry-cell batteries; the Philip Carey Manufacturing Company, asbestos materials, in charge of H. W. Cook, and the Oneida Community, Niagara Falls, manufacturers of galvanized chains for arc lamp suspension.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

As far as general trade conditions are concerned, the convention at Chicago had no apparent effect. This was not because the nomination for the Presidency had been discounted, but because, with the present volume of business, trading is not disturbed much by political activity. During the week there was a continuance of the better feeling as to the future and some further enlargement of industrial operations was reported, especially in textile lines. Actual business was quiet, as it normally would be at this season, but not more inactive than might be expected in view of the existing circumstances. The weather reports showed a continuance of reports of excessive moisture in sections where wheat is being harvested and where corn is being cultivated. This has curtailed trade and collections Northwest and Southwest, while floods in rivers and bottom lands have checked transportation of commodities to market and added an element of doubt as to the ultimate crop outcome. East of the Mississippi River the weather has been more seasonable and a larger distribution is noted at retail on account of the additional stimulus of price reductions at many cities. It is generally agreed by retailers that stocks are not large. Fall buying has been a trifle more active in the New York market. Railroad earnings continue to show decreases. Gross earnings of a group of important roads decreased in April $28,924,865 from the corresponding month of last year, or 18 per cent. Net earnings decreased 19.8 per cent. For the four months ended with April the decreases were 13.9 per cent in gross and 21.4 per cent in net. The leather market shows a more cheerful tone. Manufacturers seem to be coming into the market and show some disposition to purchase material in anticipation of more active operations in the fall. Electrical manufacturers report a continuance of about the same volume of business as in other recent weeks. Bank clearings for the week were smaller than for the week previous and also smaller than for the corresponding week of 1907. Business failures for the week ended June 18, according to *Bradstreet's*, number 254, which compares with 253 in the previous week, and 165 in the corresponding week of 1907.

THE COPPER MARKET.

The copper market during the week ended June 22 was one of small business and firm prices. The inquiry for metal was a little better than during the weeks immediately preceding, and it was the consensus of opinion that important sales could have been made at slight price concessions. These concessions, however, so far as has been made public, were not forthcoming. It was reported that the United Metals Selling Company had refused to sell 10,000,000 lb. of copper at 12.90 cents per lb. There were many rumors of pending negotiations for large orders but their consummation was not announced. The large copper consuming concerns in this country are still admittedly short of stocks and their financial condition shows, almost without exception, sufficient ready cash to tempt even conservative managements to purchase at bargain prices. There are many indications that the domestic demand for copper will increase materially before it shows any further decline, and in Boston well informed and optimistic dealers assert with positiveness that copper is on the verge of an advance to 14 cents or perhaps 15 cents per pound in the near future. The output of copper in June in the Butte district will show, it is expected, a considerable decrease, owing to the enforced closing of the Great Falls smelter, and the paralyzed condition of the railroads, due to the great flood in the Missouri River. Any material decline in the Butte output would tend to produce better prices, because the supply and demand have been nicely adjusted by the great producers, and any unexpected falling off would disarrange the status. Daniel Guggenheim, who has returned from a three months' visit to England, France and Germany, has discussed the copper situation abroad. "Metal conditions abroad," he says, "are improving slowly but surely, especially copper. The electric copper consuming concerns appear to be in good shape. In my judgment, there is only a normal supply of metal stocks on hand. Europe is watching America keenly and is decidedly confident of our future." Exports since June 1 have been 18,449 tons, and for the week ended June 22 were 6266 tons. The total exports for June will probably be about 25,000 tons. With the light melting in this country, these exports will not prevent the accumulation of stocks. The total imports since June 1 are 3635 tons of refined, 780 tons of matte and 4180 tons of ores. It is generally believed that the stocks of copper in Europe are unusually large, especially those which yet remain in American hands. Reports from manufacturers abroad show that there is no improvement in the demand for finished material and, as manufacturers are fairly well loaded with metal, further purchases cannot be expected at this time. Little business was transacted on June 22, although there was some buying for July-August delivery. Closing quotations on the Metal Exchange, New York, on June 22, were:

Lake	12⅞ @ 13
Electrolytic	12⅝ @ 12⅞
Castings	12½ @ 12⅝

The London market was as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	58 2 6	58 2 6
Standard copper, futures	58 16 3	58 15 0
Market	Easy.	Steady.
Sales of spot		250 tons
Sales of futures		500 tons

Extreme fluctuations for the year:

	Highest.	Lowest.
Electrolytic copper, spot	13¾	12¼
Lake copper, spot	13⅞	12⅜
Casting copper, spot	13½	12⅛
London, spot	£64 5 0	£56 10 0
London, futures	64 10 0	56 17 0
London, best selected	67 10 0	60 5 0

BROWN, BOVERI & CO.—In a report to the Department of Commerce and Labor on the plant of Brown, Boveri & Co., of Baden, Zurich, Special Agent Captain Godfrey L. Cardin writes in high terms of the shop organization and technical administration. The workmen, he says, do not seem to be different in type from those found in Zurich, and the high state of efficiency at Baden is more than ever a case of administrative methods and supervision. The firm is constructing practically every standard form of electrical apparatus, and also builds steam turbines of the Brown-Boveri-Parsons type. The high character of the work turned out, both in electrical apparatus and turbines, may be better understood when it is known that Brown, Boveri & Co. have installed in Germany, the home of the largest and most advanced electrical manufacturers in Europe, almost as many modern alternating current central stations as have the Germans themselves. Brown, Boveri & Co. undertook, at their own risk and expense, the electrification of the Simplon tunnel, and it was not until after the great work of electrifying the traffic over the Simplon road was made a perfect success that the whole equipment was taken over by the Federal railways of Switzerland.

CONTRACTS LET FOR NEW CORN PRODUCTS PLANT.—The Allis-Chalmers Company has secured contracts for the installation of machinery at the new plant of the Corn Products Company at Argo, Ill., which will be the largest glucose plant in the world. Argo is a new town, near Summit, Ill., on the Chicago drainage canal. The machinery to be furnished by the Allis-Chalmers Company includes one 1500-kw, 480-volt, three-phase, 25-cycle alternator, and one 600-kw generator of the same type. These will be driven by a horizontal, cross-compound, heavy duty, non-condensing Allis-Chalmers Corliss engine. In addition there are in the contract two high-duty pumps and an equipment of individual induction motors. Of the latter about 300 will be required. The Allis-Chalmers Company has already supplied motors of similar types for the Corn Products Company at Davenport, Iowa, Waukegan, Ill., Oswego, N. Y., and Edgewater, N. J. The contract just let for Argo, Ill., will involve, it is announced, almost $150,000. The same company has furnished the motor equipment for the Chalmette refinery of the American Sugar Refining Company, aggregating about 400 25-cycle induction motors.

WESTERN ELECTRIC COMPANY IN MINNEAPOLIS.—The Western Electric Company is establishing a Northwestern headquarters in Minneapolis, where it has begun the construction of a building which it expects to occupy in October.

RECENT SALES OF ALLIS-CHALMERS APPARATUS.—Judging from the number of contracts closed by the Allis-Chalmers Company for electrical apparatus during the month of May, it would appear that the demand for more power facilities is making headway in the face of panic-bred conservatism. The City of Lawrenceburg, Tenn., is a recent purchaser of a 250-kw water-wheel type alternator and exciter. The Washburn Crosby Company, of Minneapolis, Minn., has added a 200-hp induction motor to its power equipment. The Natural Food Company, of Buffalo, N. Y., will install a 150-hp induction motor. The Pratt Light & Ice Company, of Pratt, Kan., is a recent purchaser of a 100-kw and a 50-kw generator with exciters and a 50-hp motor. The New Jersey Consolidated Water & Light Company, of Elberon, N. J., has ordered a 175-kw belted alternator. The Standard Hosiery Company, of Philadelphia, Pa., will install 28 induction motors, ranging in rating from 2 hp to 50 hp. The Great Western Portland Cement Company has purchased an 800-kw generator for installation in its plant at Mildred, Kan. A 1500-kw turbo-alternator will be installed in the Dan River Cotton Mill, Danville, Va., and the Citizens' Electric Company, of Williamsport, Pa., will install a 300-kw engine-type generator unit. The Pend d'Oreille Electric Company, of Sand Point, Idaho, recently placed an order for a 225-kw engine-driven set with exciter and switchboard, and the Northampton (Mass.) Electric Light Company for a 250-kw, three-phase, 60-cycle alternator. The John Williams Manufacturing Company, of Philadelphia, has purchased two 150-kw engine-driven generator sets. Libby, McNeil & Libby Company, of Chicago, has ordered a line of induction motors in units of from 10 hp to 40 hp. The Schlitz Brewing Company, Milwaukee, has purchased 20 induction motors, ranging in size from 3 hp to 40 hp, for installation in a new malt house. The Cudahy Packing Company at Cudahy, Wis., will install, in addition to its present large line, nine new induction motors in the sausage-room, ranging in rating from 10 hp to 40 hp. The Benito Juarez Mines Company, Salinas, Mex., has ordered a full equipment of generators and motors, the latter ranging from ½ hp to 50 hp, for operating a new gold stamp mill.

Financial Intelligence.

THE WEEK IN WALL STREET.

The Wall Street market shows a distinct improvement since the nomination of Mr. Taft at Chicago, although it is a betterment that is not chronicled so much in net gains as in general tone and awakening interest. The nomination of Mr. Taft removes one element of uncertainty, which is always a desirable change when conditions are unsettled, as at the present time. The volume of trading was larger last week and the conditions of good crop prospects and cheap money, which usually mean better business and prices, are favorable. The market has not been without disturbing features, however, which are responsible for the main declines for the week. The funding of the Erie coupons and the passing of dividends by the Lake Erie & Western Railroad and the Cleveland, Cincinnati, Chicago & St. Louis Railway, and the reduction in dividend by the Louisville & Nashville Railroad, were depressing factors. The action taken by the two latter roads was considered the exercise of such economy as conservative business management would dictate. While the reduction in steel prices has not been productive of the new business that was anticipated, it was announced that the Carnegie Steel Company had been booking sufficient new business to enable it to put back at work a number of men who had been laid off. The estimated earnings of the Steel corporation, which were placed at about $36,500,000 for the quarter, were far below those of the corresponding quarter last year, but it was pointed out that this was almost $4,000,000 ahead of the low-water mark during 1904. The market on June 22 was weak and at the close showed a decided tendency to decline, especially in many of the railroad issues. This movement was attributed to liquidation in Rock Island issues. The pressure to sell these securities was not satisfactorily explained in the street, but from authoritative and official quarters it was directly asserted that nothing in the affairs of the properties warranted a marked decline. It was said that floods in the Southwest had interfered with traffic. Baltimore & Ohio, Chesapeake & Ohio, Reading and Union Pacific stocks were especially weak in the railway list, while among the industrials, American Locomotive, Amalgamated Copper, American Sugar Refining and Western Union headed the downward movement. Westinghouse common was exceptionally strong and recorded an advance on June 22 of 4½ points. The table quotes the prices at the close on June 22:

NEW YORK.

	June 15.	June 22.	Shares Sold.		June 15.	June 22.	Shares Sold.
All-Ch.	10	11	4,950	Int.-Met., com..	10⅜*	10¾	2,250
All.-Ch., pfd....	29¼	33	4,300	Int.-Met., pfd...	28½	27⅜	2,980
Amal. Cop.....	67⅛*	66¼	81,920	Mackay Cos....	66*	65⅜*	200
Am. D. T.....	39*	39*	———	Mackay Cos., pfd	64*	65¾*	200
Am. Loc.....	48¾	41¼	11,374	Met. St. Ry....	23*	25*	———
Am. Loc., pfd..	102	101½*	600	N. Y. & N. J. Tel.	109	109*	10
Am. Tel & Cbl.	65	65*	———	Steel, com.....	37¼	36½	133,770
Am. T. & T....	118½	117⅜	3,305	Steel, pfd.....	101⅝	100⅞	9,130
B. R. T.....	47⅛	45¾	12,625	W. U. T.....	—	53½	350
Gen. Elec.....	133¾	130⅜	1,658	West'h, com....	44¾	54½	7,140
Hud. R. Tel....	—	—	———	West'h, pfd.....	71*	70	953

PHILADELPHIA.

	June 15.	June 22.	Shares Sold.		June 15.	June 22.	Shares Sold.
Am. Rys.....	44¼	44⅜	———	Phila. Elec.....	9½	9⅜	———
Elec. Co. of Am.	10⅛	11	———	Phila. R. T.....	13½	13⅞	———
Elec. Stor. B'ty.	30	32	———	Phila. Traction..	87¾	87	———
E. S. B'ty, pfd..	49*	49*	———				

CHICAGO.

	June 15.	June 22.	Shares Sold.		June 15.	June 22.	Shares Sold.
Chicago City Ry.	190	96½	———	Met. Elev., com.	17½	17*	———
Com. Edison....	97½	96½	———	Met. Elev., pfd.	53	50*	———
Chicago Subway.	19½	19⅛	———	National Carbon.	67	69½*	———
Chicago Tel. Co.	130⅜	130	———	Nat. Carbon, pfd.	112	112*	———

BOSTON.

	June 15.	June 22.	Shares Sold.		June 15.	June 22.	Shares Sold.
Am. Tel. & Tel.	118¾	117¾	———	Mass. E. R., pfd.	46	47	———
Comb'ind Tel...	—	—	———	Mex. Tel., pfd..	—	—	———
Edison El. Ill...	209	208	———	New Eng. Tel'p.	111	111½	———
Gen. Elec.....	134½	131	———	W'st Tel. & Tel.	6*	6*	———
Mass. Elec. Ry..	9½	10½	———	W. T. & T., pfd.	65	65¼*	———

*Last price quoted.
Shares sold are for week June 15 to June 22.

DIVIDENDS.

Cumberland Telephone & Telegraph Company, Nashville, Tenn., quarterly, 1¾ per cent, payable on July 1.

El Paso (Tex.) Electric Company, preferred, 3 per cent, payable on July 13.

American Cities Railway & Light Company, New York, quarterly, 1½ per cent, payable on July 1.

Seattle (Wash.) Electric Company, common, 2¾ per cent, payable on July 15.

Union Switch & Signal Company of Pittsburg, common and preferred, 3 per cent, payable on July 10.

Utah Consolidated Copper Company, quarterly, 10 per cent, payable on July 15.

National Carbon Company, Cleveland Ohio, preferred, quarterly, 1¾ per cent, payable on July 1.

American Telephone & Telegraph Company, quarterly, 2 per cent, payable on July 15.

Bell Telephone Company of Canada, quarterly, 2 per cent, payable on July 15 .

Tri-City Railway & Light Company, Davenport, Ia., quarterly, 1½ per cent, payable on July 1.

Cleveland (Ohio) Railway, quarterly, 1½ per cent, payable on July 1.

Washington Water Power Company, Spokane, Wash., quarterly, 1¾ per cent, payable on July 1.

Manila Electric Railroad & Lighting Company, quarterly, 1 per cent, payable on July 1.

Bell Telephone Company of Missouri, quarterly, 2 per cent, payable on July 1.

Stark Electric Company, Canton, Ohio, quarterly, ¾ of 1 per cent, payable on July 1.

Cumberland Telephone & Telegraph Company, Nashville, Tenn., quarterly, 1¾ per cent, payable on July 2.

NEW YORK & PORT CHESTER RAILROAD.—The Public Service Commission of the First District of New York will investigate the New York & Port Chester Railroad and especially its relations with the New York, Westchester & Boston Railway and the manner of acquisition of control of both companies by the New York, New Haven & Hartford Railroad. On May 5 the Board of Aldermen of New York City, reciting the terms of the franchise granted to the New York & Port Chester road on May 31, 1906, one of which was that $800,000 should be spent in construction within the city limits within two years, asked the Public Service Commission to request the company to state what had been done to comply with these conditions. The Public Service Commission issued an order to the railroad company instructing it to explain its failure to comply with the terms, limiting the time for a response to June 12.

On June 15, attorneys for the road wrote to the commission that the Board of Estimate had extended the time for compliance with the conditions of the franchise to June 26. This response the Public Service Commission did not consider satisfactory, and therefore an investigation was ordered.

PUBLIC SALES FOR UTILITY SECURITIES IN NEW YORK.—The Public Service Commission of the First District of New York determined some time ago, it is now announced, that all bonds issued by public utility corporations must be sold at public auction or in some equivalent manner. The announcement of this determination, it is said, has been withheld pending the issue of the Manhattan Railway Company's $11,712,000 refunding bonds. On account of the protest of officers of this company the matter was delayed, and it was in the nature of a compromise that a proviso was inserted in the permit for the issue of these securities that, if disposed of at private sale, they must bring a price of 91 or over. The announcement regarding the method of public sale reads: "Unless the said bonds shall be sold at private sale on a basis of not exceeding 4 4/10 per cent and accrued interest, the treasurer of the company shall invite proposals for the purchase of said bonds to be publicly advertised daily for not less than six days in at least four daily newspapers published in the city of New York, to the end that the time and place of the sale shall be generally known; and the treasurer shall award the said bonds to the highest bidder or bidders therefor. Said proposals shall only be opened publicly by the treasurer of the company and in the presence of all the Public Service Commissioners for the First District, or of such of them as shall attend at the time and place specified in said public advertisement." It is held by the Public Service Commissioners that issues authorized by them carry practically a guarantee from the State that the securities are what they are represented to be, and that under these circumstances such issues will have as staple a market as municipal bonds. Commissioner Bassett said: "The purpose of this move is to guard against watering of public utilities securities. That is the most important question with which the Public Service Commission has to deal at the present time. The matter of overcapitalization is at the root of the defects of the public utilities companies, and the commission intends to do everything in its power to eradicate this evil." The applications for security issues now pending before the Public Service Commission include those of the following companies: Brooklyn Union Gas Company, Kings County Electric Light & Power Company, Coney Island & Brooklyn Railroad and Long Acre Electric Light Company.

WESTINGHOUSE REORGANIZATION PLAN ASSURED.—At the expiration, on June 22, of the time allowance granted stockholders of the Westinghouse Electric & Manufacturing Company to subscribe to the new stock proposed under the merchandise creditors' plan, it was agreed that the success of the plan was assured. While the various sub-committees, receiving the subscriptions of the stockholders, had not fully tabulated their returns up to the hour at which this report is closed, it was said by a member of the committee that fully 80 per cent of the $6,000,000 new stock allotted to the old shareholders under the plan had been subscribed and that practically all of the $4,000,000 allotted to the merchandise creditors had been taken. This assurance was given by a representative of the creditors' committee. Mr. A. W. Krech, chairman of the stockholders' committee, could not give out definite figures until all of the late returns were counted, but he was confident that in the neighborhood of $5,000,000 stock had been taken by the stockholders. An official of the Westinghouse company said that, while no official statement could be made in advance of the meeting of the reorganization committees and the receipt of their reports, the management was assured that the reorganization plan was a practical success and that, either by a short extension of the time allowed for stockholders to subscribe or by some other means to be suggested by the reorganization committee, the details would be completed. This official said that as approximately 90 per cent of the new stock had been subscribed it was assured that the property would not be allowed to go to sale, at least not until every resource had been exhausted to secure the remaining subscriptions necessary to raise the total to the $10,000,000 required. Mr. George Westinghouse, who was in New York when the reports of the committees were being prepared, expressed great confidence in the success of the plan and was sure that any plan involving a foreclosure had been forestalled. A report was in circulation in financial circles that Mr. H. C. Phipps, of Pittsburg, had agreed, before his departure for Europe, to make good any shortage in the stockholders' subscription, but Mr. Westinghouse said he had never heard of such an offer.

LARGE CONTRACT AWARDED BY PUBLIC SERVICE CORPORATION.—The General Electric Company has concluded an important contract with the Public Service Corporation of New Jersey for new equipment, the amount involved being more than $300,000. The principal items in the contract are for the Marion station and consist of a 9000-kw Curtis turbo-generator and 150-kw turbine exciter. A switchboard and other necessary appliances will also be installed. This machinery is to increase the railway equipment of the corporation. At the Cranford station a 1500-kw horizontal turbo-generator and a 35-kw turbine exciter will be installed. This is one of the new model horizontal turbine units which the General Electric Company now manufactures. For the Lakeside Avenue substation at Orange a 1000-kw rotary converter will be installed for service on the railway. In the Englewood and Hudson substations transformers for lighting service have been ordered. At the City Dock station, Newark, a 3000-kw frequency changer and switchboard are to be installed, and at Camden, N. J., a complete equipment for 250 magnetite arc lamps, including regulation switchboard, etc., will be added. All the material will be installed ready for service in the fall.

AMSTERDAM CORPORATION FORMED BY W. J. WILGUS.—The Amsterdam Corporation has opened offices at 165 Broadway, New York. William J. Wilgus is president and Henry J. Pierce, vice-president. The corporation was formed for the purpose of acting as engineer on special railroad problems. These problems are specified as electrification of steam lines, subaqueous tunnels, construction and equipment of urban and interurban lines, preparation of plans for passenger and freight terminals and furnishing analyses of operating contracts. While the principal work of the company is to give advice regarding these matters, it is prepared to act as agent for a company in supervising and directing new construction. It is stated that no alliance or connection will be made with any manufacturing or supply company. Mr. Wilgus was formerly vice-president of the New York Central Railroad. Mr. Pierce is president of the International Railway Company, of Buffalo, and also president of the Netherlands Tramway Corporation. The Amsterdam Corporation was incorporated in Connecticut in September, 1905. Mr. Wilgus states that it is a close corporation, all of the shares of which are held by three individuals, who constitute the board of directors. These are Messrs. Wilgus, Pierce and J. A. Byrne, a lawyer connected with the firm of Parker, Hatch & Sheehan.

TO ATTACK NEW YORK TRANSFER DECISION.—Public Service Commissioner John E. Eustis, of the First District of New York, declared in an address before the North Side Board of Trade at Yonkers that the commissioners were determined to preserve to the people of Westchester County the privileges they now enjoy in transfers to the lines of New York City. F. W. Whitridge, receiver of the Third Avenue Railroad and the Union Railway, has been empowered by Judge Lacombe, of the United States Circuit Court, to discontinue the transfers within 30 days. Mr. Eustis said that the commission possesses jurisdiction over the questions of rates and transfers, and after considering carefully the monthly earnings of the roads, will find some way of compelling the receiver to respect the orders of the commission.

SUIT TO LEGALIZE ISSUES OF NEW HAVEN SECURITIES.—A suit has been brought by security holders of the New York, New Haven & Hartford Railroad, through Mackay & Company, of New York, which seeks, through the Connecticut Supreme Court of Errors at New Haven, to obtain a decision sustaining the company's right to issue its securities and those of subsidiary corporations under authority of the Connecticut Legislature without obtaining permission of the Massachusetts Legislature. This suit is brought, it is said, because of attacks made upon the securities of the New Haven company during discussion of the various bills bearing upon the proposed merger of the New Haven and the Boston & Maine systems.

PACIFIC GAS & ELECTRIC COMPANY.—Justice Greenbaum, of the Supreme Court of New York City, has refused to continue the injunction obtained by the Industrial General Trust Company, of London, England, representing holders of $240,000 of 6 per cent debenture bonds of the Pacific Gas &

Electric Company, of San Francisco, which restrained that corporation from carrying into effect the plan by which the holders of $3,529,000 of these bonds were permitted to exchange them for an equal amount of debenture mortgage bonds of the company. The court held that the new plan does not violate the agreement of the original issue. The complainants took an appeal to the Appellate Division, and argument was heard on June 19. No decision has been rendered.

TRACTION EARNINGS NOT SERIOUSLY DECREASED.—While gross earnings of some of the traction companies are still showing decreases, revenues of such properties are, as usual in a period of this character, holding up much better than those of steam roads and many classes of industrials. The following figures show the earnings of traction companies operating in widely separated sections. The gross earnings are tabulated for the latest reported periods in 1908, together with the comparative increase or decrease from the corresponding periods in 1907:

Gross earnings.	May, 1908.	Decrease under May, 1907.	5 mos. ended May 31, 1908.	Decrease under 5 mos. end May 31, 1907.
United Railways of St. Louis	$920,765	$26,573	$4,248,216	$78,207
American Railways Co.	246,897	2,271	1,070,789	32,295
Twin City Rapid Tr.	‡404,785	*22,808	‡2,424,761	*109,348
Syracuse Rapid Transit	108,280	*6,391	517,203	*26,623
Toledo Rys. & Light	40,893	805	554,157	36,383
North. Ohio Tr. & Light	†129,804	3,040	†504,889	3,838
Detroit United Railway	363,900	3,900	2,415,075	18,849
East St. Louis & Sub.	159,882	19,723	811,267	8,724
Utd. RR's of San Francisco	†564,673	*21,117	†1,559,687	29,366

*Increase. †Period of April and 4 months to April 30. ‡Period of 3 weeks of May and Jan. 1 to that date.

AMERICAN LOCOMOTIVE COMPANY.—Directors of the American Locomotive Company are expected at their forthcoming meeting to declare the regular quarterly dividend of 1¾ per cent on the preferred stock, but it is reported that the quarterly dividend of 1¼ per cent on the common stock, which has been paid regularly since August, 1906, will be cut or passed. During the year to end June 30, 1908, the earnings naturally will be reduced from the preceding year because of the depression of the last few months, but will be enough to justify the continuance of the common dividend for a period if the directors see fit to declare it. Collections in the last four or five months have been satisfactory and the company has the necessary funds with which to meet the dividend.

HUDSON RIVER ELECTRIC POWER COMPANY.—The Hudson River Electric Power Company, which owns the large dam across the Hudson River at Spier Falls, has made an application to the Public Service Commission at Albany for an order cancelling a former order of the commission authorizing an issue of $3,000,000 refunding and consolidated mortgage bonds. It had been intended to use the proceeds of this issue in the construction of a large dam on the Sacandaga River at West Falls. Since the State Water Supply Commission has reported in favor of creating a storage reservoir on this river, the power company declares that its new dam will not be needed. The Public Service Commission has taken the application under consideration.

REPORT OF ELECTRIC PROPERTIES COMPANY.—The report of the Electric Properties Company for the fiscal year ended April 30, 1908, as compared with the 11 months ended April 30, 1907, shows the following: Interest and dividends received, $280,671, a decrease of $117,577; expenses, $85,630, a decrease of $19,114; balance, $195,041, a decrease of $98,463; preferred dividends, $179,344, an increase of $51,287. No dividends were declared on the common stock in the year just ended, but in the 11 months ended April 30, 1907, there was disbursed for this purpose $120,000. The surplus at the end of the last fiscal year was $14,126, which, with the previous surplus of $35,447, makes a total of $49,573.

NOTES ISSUED BY HUDSON COMPANIES.—The Hudson companies, controlling the various tunnels under the Hudson River, which have been built by William G. McAdoo and his associates, has arranged to issue $5,000,000 of 1-year 6 per cent notes secured by a deposit of $10,000,000 of 4½ per cent bonds. In February the company disposed of $15,000,000 similar notes, secured by bonds. These notes mature on August 1, 1910. The company will not place its bonds on the market until the tunnels are completed and earning capacity can be measured. It is stated that the sale of the new notes provides the company with sufficient funds to complete the work projected at this time.

BUTTE (MONT.) ELECTRIC & POWER COMPANY.—It is expected that the directors of the Butte Electric & Power Company will declare, at a meeting to be held within a few days, a quarterly dividend of 1¼ per cent. This was the rate of dividend until payments were discontinued six months ago. Earnings of the company are said to be higher than during last year, and the management believe it will be able now to market $1,000,000 of the $5,000,000 6 per cent bonds authorized last year. The bonds are a mortgage on properties of the Butte Electric & Power Company, the Madison River Power Company, and the Billings & Eastern Montana Power Company.

MONTREAL LIGHT, HEAT & POWER COMPANY.—The annual report for the year ended April 30, 1908, of the Montreal Light, Heat & Power Company gives gross earnings of $3,792,218, as compared with $3,453,490 in 1907. Expenses were $1,651,656, against $1,529,270 in 1907, and the net $2,140,562, as compared with $1,924,220 for the previous year. Deducting interest charges of $493,095 gives a surplus of $1,647,467, equal to 9.69 per cent earned on the $17,000,000 capital stock. Dividends of $1,020,000 were declared making a surplus for the year of $627,467, as compared with the surplus of 1907 of $590,582.

BONDS OF TAMPA (FLA.) ELECTRIC COMPANY SOLD.—The $600,000 first mortgage 5 per cent bonds issued by the Tampa Electric Company have been sold to a syndicate composed of Redmond & Company, of New York, and Warner, Tucker & Company, of Boston. The bonds mature June 1, 1933, and are offered for sale at 93¼ by the syndicate and by Stone & Webster, general managers of the property. The Tampa Electric Company operates 41 miles of track.

MONTREAL STREET RAILWAY COMPANY.—The report of the Montreal Street Railway Company for May and the eight months ended May 31 shows increases in gross and net earnings and the surplus. Gross earnings for May were $313,678, as compared with $295,951 in May, 1907, while for the eight months ended May 31 shows increases in gross and 635 for the corresponding period of last year. The surplus increased from $425,240 in the 1907 period to $470,140 in 1908.

PHILADELPHIA RAPID TRANSIT SUBSIDIARY PROSPERS.—The Thirteenth & Fifteenth Streets Passenger Railway, a subsidiary of the Philadelphia Rapid Transit Company, and leased to it for 999 years for an annual rental of $12 per share on the stock, will pay an extra dividend amounting to $20,000, or $1 per share, July 1, from a surplus of $27,000 which has accumulated in the treasury.

BOSTON & REVERE ELECTRIC STREET RAILWAY COMPANY.—The Railroad Commission has been asked by the Boston & Revere Electric Railway Company to approve an issue of $50,000 of 20-year 5 per cent bonds, subject to call at $105. This issue is to provide funds for repaying the Boston & Northern Street Railway, lessee, sums advanced for the redemption of an issue of bonds.

MASSACHUSETTS ELECTRIC COMPANIES MAKE A GOOD SHOWING FOR MAY.—The gross earnings of the Massachusetts Electric lines show for May an increase over the same month of 1907 of 7 per cent. The April earnings showed a 6 per cent increase, while March gross was 3 per cent behind the 1907 results.

PINE BLUFF LIGHT & WATER COMPANY.—A decree of foreclosure was entered in the United States Court at Little Rock, on June 6, in the case of the New York Trust Company, of New York, against the Pine Bluff Light & Water Company, for $525,000. The property was ordered to be sold on June 9.

SHAWINIGAN POWER COMPANY INCREASES EARNINGS.—The report of the Shawinigan Power Company for the first quarter of 1908 showed earnings of $222,020, compared with $167,920 in the same period in 1907, an increase of $54,100.

CHICAGO RAILWAYS BONDS SOLD.—N. W. Harris & Company, of New York, and the other bankers that participated in the purchase, have disposed of $3,000,000 Chicago Railways Company first mortgage 5 per cent bonds.

SEATTLE ELECTRIC COMPANY.—The Seattle (Wash.) Electric Company has declared an initial dividend of 2¾ per cent on its common stock, payable on July 15.

GENERAL NEWS

Late items are printed unclassified at end of department

Construction News.

BESSEMER, ALA.—Plans are being considered by the People's Telephone Company for establishing an entirely new telephone system in Bessemer. New telephone lines will be erected to Norwood, East Birmingham and Kingston.

TUSCALOOSA, ALA.—The Birmingham Gulf Railway & Navigation Company has increased its capital stock to $10,000,000. The company proposes to construct an electric railway from Gadsden to Tuscaloosa, and from there to operate a barge line to Mobile and New Orleans.

PRESCOTT, ARIZ.—The Arizona Power Company, which is erecting a power plant 20 miles from Camp Verde, contemplates having its transmission lines extended to every section of territory within a radius of 50 miles of its power plant within a year, and expects to have its transmission lines completed and in operation in Jerome and Prescott early in 1909.

EUREKA, CAL.—E. C. Sharpe, of San Francisco, has applied for a franchise to install a telephone system in Eureka.

SAN FRANCISCO, CAL.—The Great Western Power Company has awarded the contract for the construction of its substation in East Oakland, Cal., to the Globe Construction Company. The company has also secured a site in Oakland, on which it will erect a steam power station where 25,000 hp will be developed. The cost of the plant is estimated at $500,000. Edwin Hawley, vice-president of the Western Pacific Railroad, is president of the Great Western Power Company.

SANTA MARIA, CAL.—The Board of Supervisors of Monterey County has granted a franchise to C. P. Baird and W. L. Lierly, of Santa Maria, to furnish electricity for light and power and water privileges.

VENTURA, CAL.—Julian P. Jones and Frank M. Packard, who have the franchise for an electric railway between Ventura and Ojai and the Matilija, are making arrangements to commence work on the construction of the road.

COLORADO, COL.—It is reported that work will be resumed on the construction of the plant of the Eastern Colorado Power Company's plant near Boulder.

EAST NORWALK, CONN.—The municipal electric light plant at East Norwalk will be completed and put in operation about August 1. Electrical energy for operating the system will be supplied from the municipal electric plant at South Norwalk. One hundred and fifty tungsten lamps of 32 cp will be used for street lighting. John W. Olmstead is manager.

WASHINGTON, D. C.—The Washington, Alexandria & Mt. Vernon Railway Company contemplates installing an additional steam turbine in its power station at Pennsylvania Avenue and Twelfth Street.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Washington, D. C., until June 29, to furnish at the navy yard, New York, N. Y., a quantity of naval supplies as follows: Schedule 1327—Testing generator, conduit fittings, etc. Applications for proposals should designate the schedules desired by number. Blank proposals will be furnished upon application to the navy pay office, New York, N. Y., or to the above bureau. E. B. Rogers is paymaster general, U. S. N.

WASHINGTON, GA.— Plans are being made by the Anthony Shoals Power Company to commence work on the development of its property on the Broad River in the northern part of Wilkes County in the near future. The company proposes to erect transmission lines and distribute electricity in Washington, Augusta and Elberton for commercial purposes. T. M. Patrick, of Washington, Ga., is interested in the enterprise.

ASHTON, IDAHO.—The Fremont Independent Telephone Company contemplates the erection of a number of new telephone lines into the surrounding country, and extending its lines throughout the city.

GRACE, IDAHO.—Preliminary tests have been completed of the first unit of the large power plant of the Telluride Power Company at Grace. The plant utilizes the natural flow of the Bear River. The power station is designed for 80,000 hp; the first installation furnishes 20,000 hp. The cost of the plant thus far is estimated at $2,400,000; when completed the system will cost $7,000,000. The transmission line from the Grace plant connects with the Utah system of the Telluride Company at Grace Logan. Besides furnishing electricity to the mines of Utah, Idaho and Colorado, the company furnishes electrical energy for lighting in Provo, Logan, Bingham, Eureka, Mercur, Silver City, Robinson and many other towns and mining cities. It also furnishes electricity for the Salt Lake City (Utah) light and power system.

GRANGEVILLE, IDAHO.—The Grangeville Electric Light & Power Company's dam located on the south fork of the Clearwater River was carried away by the flood.

IDAHO FALLS, IDAHO.—Plans are being made by the Idaho Power & Transportation Company to extend its transmission lines from Rigby to St. Anthony. A. W. Scott is president of the company.

NEZ PERCE, IDAHO.—Arrangements have been completed for the construction of an electric railway from Nez Percé to connect with the Northern Pacific Culdesac-Grangeville road in the vicinity of Vollmer. The proposition accepted by the citizens of Nez Percé provides for a bonus of $50,000 to be paid when the road is completed. The cost is estimated at $150,000. The road will be 11 miles long and will be in operation by Nov. 1. Z. A. Johnson will construct the railway.

ALEDO, ILL.—Plans are being made by the People's Telephone Company for improvements and extensions to its plant in Aledo, and also the construction of telephone lines to Viola and New Windsor.

BELLEVILLE, ILL.—The Southern Traction Company has filed a notice of increase of its capital stock from $2,500 to $1,500,000. The company is constructing an electric railway from East St. Louis to Belleville and is planning to extend the Belleville car line to Cario, Ill.

CHICAGO, ILL.—Sealed proposals will be received at the office of William Carroll, city electrician, until July 1, for furnishing the Department of Electricity, city of Chicago, Ill., with tubular steel poles, malleable iron cross arms and wrought-iron brackets, in accordance with plans and specifications on file at the above office. Proposals will also be received until July 2 for furnishing electric light and fire alarm cables as follows: 150,000 ft. No. 6 B. & S. G. rubber-covered, lead-incased electric light cable; 18,000 ft., 50 pair, No. 19 B. & S. G. solid filled core, paper insulated, lead-incased fire alarm cable; 18,000 ft., 30 pair, No. 19 B. & S. G. solid filled core, paper insulated, lead-incased fire alarm cable; 35,000 ft., 15 pair, No. 19 B. & S. G. solid filled core, paper insulated, lead-incased fire alarm cable; 25,000 ft., 5 pair, No. 19 B. & S. G. solid filled core, paper insulated, lead-incased fire alarm cable. Proposals must be made out on blanks furnished by the city electrician.

FLANAGAN, ILL.—The Pontiac Automatic Telephone Company has applied to the Village Board for permission to install a telephone system in Flanagan.

FORT WAYNE, IND.—The Fort Wayne & Springfield Railway Company is planning to extend its railway from Decatur, Ind., to Lima, Ohio, a distance of 50 miles.

HARTFORD CITY, IND.—The officials of the Hartford City Electric Light Company have decided to make additional improvements to the local plant, including the installation of new boilers, new electrical machinery and other equipment, which will involve an expenditure of about $4,000.

MADISON, IND.—Bids will be received by the City Council for lighting the streets, alleys and public places by electricity, and for furnishing electricity for commercial lighting and for motors; also for the maintenance and operation of an electric railway in the city for a term of 10 years. Bids will be received jointly or separately. F. M. Harper is chairman of the utilities committee.

KIRWIN, KAN.—The Enterprise Telephone Company contemplates placing all its wires underground in the business section of the city.

ST MARY'S, KAN.—Plans and specifications are being prepared for an electric light plant in St. Mary's, by Burns & McDonnell, of Kansas City, Mo.

STOCKTON, KAN.—Application has been made to the City Council by H. L. Ream, of Beloit, Kan., and J. W. Harris, of Lincoln, Neb., for a franchise to construct an electric light plant in Stockton.

FRANKFORT, KY.—Bids will be received until July 10 for the construction of the new power house in connection with the new capitol.

LOUISVILLE, KY.—The franchise granted by the Council to the George G. Fetter Company, which has been declared valid by the court of appeals, will be sold. The Kentucky Electric Company has been fighting to prevent the sale of the franchise.

FRANKLINTON, LA.—The City Electric Company contemplates installing an electric light plant, the equipment of which will consist of a 15-kw, 220-volt, direct-current dynamo, a 30-hp engine and a boiler of 35 hp. W. A. Erwin is interested in the enterprise. Mr. Erwin also wants prices on a small dynamo to furnish electricity for about 20 lamps of 16 cp and two street lamps.

BLANFORD, MASS.—The Farmers' Telephone Company is contemplating the extension of its system from Blanford to Chester.

CLINTON, MASS.—The contract for the construction of the power house for the Bigelow Carpet Company has been awarded to J. W. Bishop Company, of Worcester. The cost of the building is estimated at $140,000, and with equipment the plant will cost about $500,000.

DANVERS, MASS.—The Electric Light Commissioners have decided to increase the price of electricity for incandescent lamps from 10 cents to 11 cents per kw-hour, the new rate to take effect July 1 and to remain in force until July 1, 1909. This increase, it is said, was made necessary owing to the extra expense this year caused by the accident at the power station last fall. The department contemplates putting all contracts for electricity for motors on a meter basis after May 1, 1909. A rearrangement of rates will also be made for power service at that time.

LEE, MASS.—The Lee Electric Light Company has submitted a proposition to the citizens' committee of Lenoxdale to build a transmission line to Lenoxdale and furnish electricity in that village. Under the present plans the Lee Electric Light Company will furnish the electrical energy, which will be distributed by the Lenoxdale company. Work will commence on the project as soon as arrangements have been completed.

MALDEN, MASS.—The Council has authorized the Street and Water Commission to make a contract with the Malden Electric Company for lighting the streets of the city for a term of three years, at an annual cost of $32,529.

ROCKLAND, MASS.—The Electric Light & Power Company, of Abington and Rockland, has extended its service to Hanover Four Corners, and is now making plans to extend its transmission lines into Norwell. It is planned to convert the local plant into a substation and secure electricity for operating the system from the East Bridgewater plant.

LUDINGTON, MICH.—Extensive improvements are being considered by the Michigan State Telephone Company in Ludington, which will involve the entire reconstruction of the local system and the erection of several telephone lines into the surrounding country, at an expenditure of about $50,000.

DULUTH, MINN.—At the annual meeting of the Duluth-Edison Electric Company called for July 4, the stockholders will be asked to authorize an increase of capital stock from $2,000,000 to $2,250,000, which is to be issued in lieu of bonds for construction work.

DULUTH, MINN.—The City Council has authorized City Attorney Wilson to make an investigation as to whether the Great Northern Power Company can be compelled to furnish electrical energy to operate the municipal electric light plant should the city decide to install one. The contract with the Duluth Edison Electric Company for lighting the city expires two years from next July, but it may be terminated by notice within one year from next July.

MANKATO, MINN.—Plans are being considered by the Mankato Electric Traction Company to construct an electric street railway in Kesota, Minn. H. E. Hance is superintendent.

BURLINGTON JUNCTION, MO.—The capital stock of the Burlington Junction Electric Light & Power Company has been increased from $6,000 to $7,000.

COLUMBIA, MO.—A mutual telephone company is being formed in Columbia, and an application for a franchise has been made to the City Council by Attorneys Harris and Carter, who are interested in the company.

CASSVILLE, MO.—The Cassville & Western Railway Company is making arrangements to electrify its road, which now connects Exeter and Cassville, Mo., a distance of five miles. The road, it is said, will be extended. S. M. Mitchell is president and general manager.

EXCELSIOR SPRINGS, MO.—The Clay County Telephone Company has been granted a 20-year franchise to install a telephone system in Excelsior Springs.

KANSAS CITY, MO.—The Missouri & Kansas Interurban Railway Company is considering the question of changing the motive power of its system from gasoline to electricity. The company operates a car line from Kansas City, Mo., to Olathe, Kan.

KIRKSVILE, MO.—The Kirksville Light, Power & Ice Company, recently incorporated, contemplates the construction of an electric light and power plant, also an ice plant in Kirksville. J. H. Moore is engineer in charge.

OREGON, MO.—The contract for constructing the proposed electric railway from Oregon to Forest City, a distance of four and one-half miles, has been awarded to M. A. Wogan, of Kansas City, Mo., by the Oregon Interurban Railway Company. The cost of the road is estimated at $40,000, which does not include equipment. L. I. Moore is secretary and treasurer.

ST. LOUIS, MO.—The West End Light & Power Company has petitioned the Board of Public Improvement for authority to erect transmission lines for the distribution of electricity in the district embraced within Duncan and Lindell Avenues, Newstead Avenue and King's Highway. Jesse D. Dana is president.

BILLINGS, MONT.—Preliminary surveys are being made by the Stillwater Power & Railway Company for a proposed electric railway from Columbus to Cooke City, Mont. Power for operating the road will be developed from two falls on the Stillwater River. Willard Bennett, of Helena, is president.

FAIRBURY, NEB.—The Independent Telephone Company, of Fairbury, is planning to construct two copper metallic circuits between Fairbury and Dewitt.

TALMAGE, NEB.—The citizens are considering the question of installing an electric lighting plant.

NEWARK, N. J.—Work has commenced on the third section of the power plant of the Public Service Corporation in the Marion section of Jersey City. The contract for the electrical equipment, which includes a 9000-kw turbo-generator, has been awarded to the General Electric Company, of Schenectady, N. Y. Dudley Farrand is general manager.

NEWARK, N. J.—Steps have been taken by the lighting committee of the Common Council for the establishment of a municipal electric lighting plant. A sub-committee was appointed to ask for an appropriation of $10,000 with which to secure the services of an engineer and prepare plans for the plant. It is said that under the agreement between the city and the New York & New Jersey Telephone Company the company would be obliged to furnish space in its underground for the wires used in connection with the municipal lighting plant.

NEW PROVIDENCE, N. J.—The Township Committee has decided to extend the street lighting system to Berkeley Heights, N. J. The service will be furnished by the Commonwealth Water & Light Company, of Summit, N. J. It is proposed to install 50 incandescent lamps at an estimated cost of $750 per year. H. M. Whitehead is manager of the Commonwealth Water & Light Company.

NEWTON, N. J.—An independent telephone company has been organized in Newton, for the purpose of giving long-distance service to the Great Meadow District in Warren County.

PATERSON, N. J.—Mayor McBride has recommended the Board of Public Works to take steps to have all telephone and electric wires placed in underground conduits at once.

AMSTERDAM, N. Y.—Plans are being made by the Automatic Telephone Company to extend its lines to Tribes Hill and Fort Hunter.

BATAVIA, N. Y.—The Batavia Light & Power Company has decided to go out of business permanently, and has notified its customers that it will not furnish either gas or electric service after July 16.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has submitted a proposition to the Board of Contract and Supply offering to furnish electricity for lighting the streets of the city as follows: On a one-year or two-year contract for 420 arc lamps or more the company will furnish lamps at $84 per lamp per year; on a three-year contract, $84 per lamp per year to and including 400 lamps; all lamps in excess of 400 lamps at the rate of $80 per lamp; for 480 incandescent street lamps on a one, two or three year contract, $21.50 per lamp per year; for a three-year contract, $21.50 per year per lamp, to and including 500 lamps; all lamps in excess of 500 at the rate of $21 per lamp per year. The company will furnish on a three-year contract for both arc and incandescent street lamps to provide for 420 arc lamps or more, and 480 incandescent lamps as follows: Arc lamps, $80 each for first year; second year, $75 each, and the third year, $70 each; incandescent lamps, at the rate of $20 each per year for the three years. The company also offers to furnish electricity for lighting the city hall and other public buildings, including the free renewals of standard 4, 8, 16 and 32 cp incandescent lamps, at 6 cents per kw-hour. The action on the bids was postponed until the next meeting of the board.

BREWSTER, N. Y.—The Hudson River Telephone Company contemplates the construction of a telephone line from Brewster to the Connecticut state line, where connections will be made with the Southern New England Telephone Company's telephone lines.

BUFFALO, N. Y.—The Laws and Legislation Committee of the county has decided to report in favor of rejecting the proposal of the General Electric Company for furnishing electricity for lamps for the Seventy-fourth Regiment at six cents per kw-hour, and instead a recommendation will be made to advertise for bids for furnishing the county with an engine and generator.

GLENS FALLS, N. Y.—The Hudson River Electric Power Company has applied to the Public Service Commission for an order cancelling the former orders of the commission given in December, 1907, authorizing an issue of $3,000,000 in bonds. The company had planned to use the proceeds of the bonds for the construction of an additional large dam on the Sacandaga River at West Falls.

LIMA, N. Y.—The Lime-Honeoye Electric Light & Railroad Company is making surveys for an extension north to Rochester and south to Atlanta and Wayland, a distance of 69 miles. C. A. Watkins is chief engineer.

MONROE, N. Y.—The property holders between Monroe and Walton Lake are considering a project to have the electric lighting service extended to Walton Lake. They have decided to subscribe to sufficient stock of the Orange & Rockland Electric Company to pay for the construction of the transmission line, the cost of which is estimated from $1,800 to $2,000.

NEW YORK, N. Y.—Plans for enlarging and remodeling the power station of the United Electric Light & Power Company on 146th Street west of Amsterdam Avenue has been filed. The cost of the improvements is estimated at $18,000. W. E. McCoy is electrical engineer.

NEW YORK, N. Y.—Bids will be received until June 29 by C. B. J. Snyder, superintendent school buildings, for installing electric equipment in new Public School No. 93, Borough of Brooklyn, and for alterations and additions to the electric equipment in Public Schools Nos. 32, 48, 49, 73, 87, 93, 168, 171, Borough of Manhattan.

NIAGARA FALLS, N. Y.—Permission has been granted by the Board of Public Works for the illumination of Falls Streets on application of John C. Level, chairman of the merchants' committee. The installation of the system will incur no expense to the city. The new system will extend from First Street to Riverway, the cost of which is estimated at $2,500.

SYRACUSE, N. Y.—The Public Service Commission has granted the amended petition of the Syracuse & South Bay Railroad Company for the construction of its transmission line from the line of the Niagara, Lockport & Ontario Power Company to its property in Syracuse.

WHITE PLAINS, N. Y.—Proposals will be received at the office of the Board of Supervisors until July 3 for electric equipment of the

central power plant; electric fixtures for new supreme court and hall of records buildings; vacuum cleaner, etc. Separate bids are to be received on all items. Plans and specifications can be seen at the office of Lord & Hewlett, architects, 345 Fifth Avenue, New York, N. Y. Farrington M. Thompson is secretary of committee.

BREVARD, N. C.—Rapid progress is being made on the construction of the buildings of the Transylvania Cotton Mills Company in Brevard. The first installation will be 4000 spindles, and both steam and electrical power will be used to operate the mills. J. W. McMinn is president.

WEAVERVILLE, N. C.—An independent telephone company has been organized in this city for the purpose of constructing a local system.

EDGELEY, N. D.—Plans are being made to erect a municipal electric light plant, which will be operated by natural gas.

GRAND FORKS, N. D.—E. J. Landers and others have made application for a franchise to construct a street railway system in Grand Forks.

MINTO, N. D.—The North Dakota Independent Telephone Company is planning to construct a telephone line from Minto to extend through Voss, Vesslyville and Pisek, and will also erect rural telephone lines to Ardock.

CLEVELAND, OHIO.—The Cuyahoga Light Company is contemplating extending its underground system. John C. Keys is president and manager.

BOWLING GREEN, OHIO.—The Lake Erie, Bowling Green & Napoleon Railway Company is planning to extend its system from Bowling Green to Tontogany, a distance of six miles. E. H. McKnight is general manager of the company.

LIMA, OHIO.—W. Kesley Schoepf, president of the Ohio Electric Railway Company, has submitted a proposition to furnish electricity for lighting the city and a general reduction in commercial rates. The company offers a reduction from $85 per arc lamp per year to $57.50 for a new ten-year contract. An effort is being made to prevent the erection of a municipal electric plant, for which bonds will be sold the latter part of this month.

PAINESVILLE, OHIO.—The City Council has adopted a resolution authorizing the treasurer to issue $6,500 in bonds for enlarging the municipal electric light plant.

SPRINGFIELD, OHIO.—The City Council is considering the question of establishing a municipal electric light plant.

WEST MILTON, OHIO.—Work has commenced on the construction of the hydro-electric plant and electric light system in West Milton. L. A. Pearson is interested in the project.

TOLEDO, OHIO.—The City Council has granted a franchise to the Toledo, Fostoria & Findlay Interurban Railway Company to enter the city, in return for which the company is to pay $1,000.

BRISTOW, OKLA.—An election will be held July 6 to vote on the proposition of issuing $35,000 in bonds for the purpose of installing a municipal electric light plant.

LINDSAY, OKLA.—This town has decided to construct an electric light plant and water works system. M. A. Earl & Company are the engineers. Otis Snow is town clerk.

WETUMKA, OKLA.—The citizens have voted to issue $25,000 in bonds, the proceeds to be used to install a municipal electric light plant.

PANAMA.—Bids will be received at the office of the general purchasing officer of the Isthmian Canal Commission, Washington, D. C., until July 6, for furnishing electric fuses, connecting wire, insulating tape, insulating paint, etc. Blanks and general information pertaining to this circular (No. 450) may be obtained at the above office, or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; Custom House, New Orleans, La.; 1086 North Point Street, San Francisco, Cal., and Chamber of Commerce Building, Tacoma, Wash.; also from the U. S. engineer offices in the following cities: Los Angeles, Cal.; Baltimore, Md.; Philadelphia, Pa.; Pittsburg, Pa.; Boston, Mass.; Buffalo, N. Y.; Cleveland, Ohio; Cincinnati, Ohio; Chicago, Ill.; St. Louis, Mo.; Detroit, Mich.; Milwaukee, Wis.; St. Paul, Minn.; Chattanooga, Tenn.; Louisville, Ky., and Mobile, Ala. Lieut.-Col. H. F. Hodges is general purchasing officer.

BROWNSVILLE, PA.—The Brownsville, Masontown & Smithfield Street Railway Company has awarded the contract for the construction of its proposed railway running from Brownsville to Masontown, to the Pennsylvania Railway Construction Company, of Pittsburg. The road when completed will connect Morgantown, W. Va., with Pittsburg. The power plant will be located at Masontown, on the Monongahela River, about 1½ miles west of Masontown. E. C. McCollough, of Uniontown, Pa., is the engineer.

FRANKLIN, PA.—The local electric light plant is reported to have been purchased by Jacob Cauffiel, who it is said will organize a company and apply for a franchise to furnish electricity in Johnston and surrounding country. It is proposed to enlarge the electric plant in Franklin.

GIRARDVILLE, PA.—The Schuylkill Railway Company proposes to build an electric railway over the summit of the Broad Mountain, eight miles in length, which will connect Pottsville with Ashland, Mahanoy City, Shenandoah, Mt. Carmel and Shamokin. The cost of the railway is estimated at $3,000,000.

HICKORY GROVE, PA.—A new telephone company has been organized in Hickory Grove.

JOHNSTOWN, PA.—The Southern Cambria Railway Company is planning to extend its road to Hastings.

MEADVILLE, PA.—Contracts have been awarded by the water and light committee for the construction of a new electric light plant to be in operation in September: To the Riverside Engine Company, of Oil City, Pa., for gas engine, at $4,450; for a 150-hp steam engine to the Phoenix Iron Works Company, of Reading, Pa., for $1,400; the General Electric Company, of Schenectady, N. Y., was awarded the contract for the complete electrical equipment, including generators, switchboards, lamps, etc., for $13,025. Harry Ellsworth is superintendent.

MONTOURSVILLE, PA.—The Montoursville Passenger Railway Company has filed a mortgage at the recorder's office for $150,000 to the New York Trust Company, trustee, to secure an issue of bonds. The proceeds will be used to refund the indebtedness of the company and for improvements.

PITTSBURG, PA.—The contract for the complete electrical installation in the main building, power house and tunnel in the Convent of Mercy has been awarded to the W. H. Olchiltree Company, of Pittsburg, Pa.

POTTSTOWN, PA.—The Pottstown & West Chester Electric Railway Company, it is said, will build the proposed electric railway at once if the property owners along the route will give the right of way. C. W. Talbot is president.

SUMMERHILL, PA.—The Borough Council has granted to the Summerhill Electric Light, Heat, Power and Manufacturing Company a franchise. J. T. Long is interested in the enterprise.

WILKES-BARRE, PA.—Bids will be received by Fred. H. Gates, city clerk, until July 23 for furnishing electricity for lighting certain streets for a term of three, five and seven years, beginning July 1, 1909.

YORK, PA.—The York Railways Company contemplates making extensive improvements to its railway, extending from York to Dallastown, Red Lion and Windsor, which will involve an expenditure of about $100,000.

CHATTANOOGA, TENN.—Plans are being considered by the Chattanooga Railways Company for the construction of an extension from Main Street to Rossville. D. J. Duncan is general manager.

NASHVILE, TENN.—Plans are being made by the Nashville Interurban Railway to complete the railway from Nashville to Franklin, Tenn., by Sept. 30. Contracts for rails, cars and for construction of substations will soon be awarded. Plans have been prepared by E. A. Proctor, chief engineer for the electric equipment, for which the contract will soon be let. After the car line to Franklin is completed the company proposes to build the railway to Mount Pleasant and Columbia, Tenn. H. H. Mayberry, of Nashville, is president.

GEORGETOWN, TEX.—Plans are being considered by the Georgetown Water & Light Company for improvements to its system, including the installation of an additional generator in the electric light plant. The cost of the work is estimated at $25,000.

HEREFORD, TEX.—W. F. West & Company have secured the contract for the construction of the power house for the new electric light plant.

RISING STAR, TEX.—The citizens have voted to issue bonds for the construction of water works system and an electric light plant.

TYLER, TEX.—The Tyler Electric Company, recently incorporated, has been reorganized under the name of the Tyler Electric Light & Power Company. A. E. Judge is president.

SALT LAKE CITY, UTAH.—Plans are being prepared by the Utah Light & Railway Company for the construction of a power plant in the Weber Canyon. The power house will be located about two miles from Devil's Gate, to which the water will be conveyed by a pipe line. The plant will develop about 3000 hp, and will cost about $200,000. Electricity will be distributed in Ogden and Salt Lake City.

ST. ALBANS, VT.—The substation of the St. Albans Electric Light & Power Company in St. Albans was destroyed by lightning June 14, leaving the city without electric light or street car service. The substation, including four transformers and two switchboards, was burned, and it will be probably a week or ten days before the service is resumed.

CHRISTIANSBURG, VA.—A new franchise has been granted the Virginia-Tennessee Telephone Company in this city. The company plans to install an entire new system, the cost of which is estimated at $12,000.

PULASKI, VA.—An election will be held July 10 to vote on the proposition to issue $75,000 in bonds for the construction of a hydro-electric plant. Edgar C. Wiley, of Lynchburg, is engineer.

RICHMOND, VA.—The Mayor has vetoed the ordinance authorizing an issue of $350,000 in bonds for the establishment of an electric light plant at the old pumping house and for increasing the pumping facilities of the water works. This is the second time that the provision for the construction of an electric light plant has been vetoed by the Mayor.

SEATTLE, WASH.—The contract for the power plant of the State University has been awarded to the Hallidie Machinery Company, of Seattle, Wash., for $76,605, and the contract for the construction of the power house to H. Chase & Company, of Seattle, for $16,677. Howard & Galloway are the architects and engineers.

TACOMA, WASH.—The City Council has authorized the Commissioner of Public Works to advertise for bids for the construction of a water power plant with an output of 10,000 hp, which can be further developed to at least 20,000 hp.

WENATCHEE, WASH.—Plans are being considered for the construction of an electric railway from Lucerne to the Molybdoni Mines on Railroad Creek. Surveys are now being made by the engineers of the Warren-Littleton Company, of Wenatchee.

MORGANTOWN, W. VA.—The South Morgantown Traction Company has awarded the contract for the construction of the extension to the poorhouse farm, a distance of two miles, to Frank Alfiery. The extension will cost approximately $60,000.

WHEELING, W. VA.—The contract for installing a new electric plant in the laundry building of the Home of the Sisters of the Good Shepherd has been awarded to the American Electric Company, of Wheeling. The equipment will consist of a 75-kw direct-connected generator.

CUMBERLAND, WIS.—An election will be held July 3 to vote on the proposition of rebuilding and improving the municipal electric light plant. The cost of the work is estimated at $15,000.

MILTON, WIS.—Arrangements are being made by the Milton & Milton Junction Telephone Company to construct a new telephone line between Milton and Milton Junction. Other extensions are also being considered.

MILWAUKEE, WIS.—The Milwaukee Light, Heat & Traction Company has received permission from the Wisconsin Railroad Commission to issue $2,500,000 refunding and extension mortgage, to secure funds for extensions and improvements as needed.

PESHTIGO, WIS.—The Northern Hydro-Electric Power Company, of Green Bay, Wis., is planning to erect a 10,000-hp power plant at Peshtigo, which will include the construction of a 400-ft. dam and power house. The cost of the plant is estimated at from $500,000 to $600,000. D. Mead, of Madison, Wis., is the architect and engineer.

CRESTON, B. C., CAN.—The Creston Electric Light & Telephone Company has engaged C. H. Mitchell, consulting engineer, to prepare plans for an electric plant to be operated by power from the Goat River Falls. George M. Benny is president.

MONCTON, N. B., CAN.—The Westmoreland Power Company has applied to the New Brunswick Legislature for an act to incorporate under the above title. Among the privileges asked for is the right to construct and operate electric railways in the city of Moncton and through the counties of Westmoreland, Kent and Albert.

SYDNEY, N. S., CAN.—A special committee has been appointed to consider the proposition to erect an electric light station in Sydney.

BRANTFORD, ONT., CAN.—The Brantford Street Railway Company will extend its street car line from Mohawk to Cainsville, and make extensive improvements to its system in Brantford.

FORT WILLIAM, ONT., CAN.—The Mount McKay & Kakabeka Falls Railway Company, which proposes to build an electric railway from Fort William to Kakabeka Falls, a distance of 15 miles, will purchase electrical energy for operating its system from the Kaministikwia Power Company, of Fort William, at 2200 volts, three-phase, 60 cycles, and transformed in the substation by motor-generator sets to 600 volts direct-current. G. R. Duncan is engineer.

GODERICH, ONT., CAN.—Plans are being made by the Ontario West Shore Electric Railway Company to build the section from Goderich immediately, the contract for which has been let to the Huron Construction Company. The parties who control the charter of this company are also interested in the Maitland River Power Company, which proposes to construct a power plant at Black Hole, about three miles distant from Goderich. The power company will furnish electricity to operate the electric railway.

LONDON, ONT., CAN.—The City Council has decided to accept the proposition submitted by the Hydro-Electric Power Commission, and has instructed the Mayor to sign the contract calling for 5000 hp.

MONTREAL, QUE., CAN.—The City Council has granted the Southern Counties Railway Company permission to enter the city with its proposed electric railway.

MONTREAL, QUE, CAN.—Plans are being prepared by Charles Brandeis, of Montreal, for a new steam power plant of 2,000 hp for the Saraguay Electric & Water Company. Proposals for the equipment of the plant will be called for in the near future.

MORRISBURG, ONT., CAN.—The Morrisburg Electric Railway Company will apply to the Provincial Legislature for a charter to construct an electric railway from Morrisburg to Russell, with a branch line to Winchester.

New Industrial Companies.

THE STANDARD ELECTRIC APPLIANCE COMPANY, of Lancaster, Pa., has been organized, and proposes to manufacture electrical specialities and supplies. M. S. Graves is treasurer and general manager.

THE GORE ARC LAMP COMPANY, of Brooklyn, N. Y., has been incorporated with a capital stock of $50,000, by G. I. Wooley, H. T. Berry, and H. T. Asbury, of Brooklyn. The company proposes to manufacture electric arc lamps.

THE CONSTRUCTION & ENGINEERING COMPANY, of Wilmington, Del., has been incorporated with a capital stock of $100,000, by H. S. Collette, of New York, N. Y.; W. L. Ransom, of Brooklyn, and G. W. Bunnell, of Plainfield, N. J.

THE F. L. O'BRYAN COMPANY, of Framingham, Mass., has filed articles of incorporation with a capital stock of $50,000. The purpose of the company is to manufacture electrical devices. The incorporators are: Francis L. O'Bryan and others.

THE POPULAR ELECTRICITY PUBLISHING COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $50,000, by Foree Bain, George T. May and M. F. Allen. The company proposes to carry on a printing and publishing business.

THE NATIONAL IGNITION COMPANY, of Jersey City, N. J., has been chartered with a capital stock of $150,000, by F. C. Ederlin, A. Williams, and G. W. Flaacke, of Jersey City. The purpose of the company is to manufacture electric appliances and devices.

THE UNITED MOTORS COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000, by Henry E. Tobey, Curtis R. Hathaway, Chester W. Cuthill, all of New York, N. Y., and others. The company proposes to manufacture motors, engines, machines, cars, etc.

THE IDEAL STEAM TURBINE COMPANY, of New York, N. Y., has been chartered with a capital stock of $100,000 by Francis S. Palmiero, Alfred Bonom, and Augustus M. Brown, all of New York, N. Y., and others. The company proposes to manufacture steam turbines, engines, boilers, etc.

E. CHOISTENSEN, of New York, N. Y., has been incorporated to manufacture chandeliers, fixtures, lamps, globes, etc.; also to do general electrical work. The company is capitalized at $10,000, and the incorporators are Albert R. Palmer, Frank R. Searles and Charles F. Kern, all of New York, N. Y.

THE GAS POWER MACHINERY COMPANY, of Cleveland, Ohio, has been incorporated and the following officers elected: James Z. George, president; C. E. Linsell, vice-president, and B. J. Guthery, secretary and treasurer. The company will handle the gas engine manufactured by the Lazier Gas Engine Company, of Buffalo, N. Y., and also expects to deal in everything pertaining to the gas engine industry.

New Incorporations.

PHOENIX, ARIZ.—Articles of incorporation have been filed for the International Traction & Power Company by J. A. Pfouts, Carl M. Gage, Thomas F. Durham and Thomas F. Deegan. The capital stock of the company is $50,000.

SOLOMONVILLE, ARIZ.—The Independent Commercial Telephone & Telegraph Company has been incorporated with a capital stock of $25,000. The officers of the company are: I. E. Solomon, president; H. W. Bishop, vice-president; Frank Richardson, secretary and treasurer, and Luther Green, general manager.

BUFFALO CENTER, IA.—The Buffalo Center Telephone & Exchange Company has been organized and the following named officers elected: J. G. Daum, president; F. T. Sparks, vice-president; J. J. Guyer, secretary, and T. E. Isaacson, treasurer.

TOWANDA, KAN.—The Augusta & Towanda Mutual Telephone Company is being organized by the citizens of Towanda and Augusta, for the purpose of establishing a local system and to extend into the surrounding country.

SAYLOR, KY.—The Middle Fork Telephone Company has been organized with a capital stock of $1,000 by F. Day, Harrison Williams and others. The company proposes to construct a telephone line from Saylor to Cutshin, a distance of 14 miles, and to Dayshore, a distance of 36 miles.

CANNON FALLS, MINN.—The Cannon Falls Electric Service Company has been incorporated with a capital stock of $25,000.

WAITE PARK, MINN.—The Le Sauk Rural Telephone Company has been organized by Peter Lahr, Clarke Waite, John H. Feddema and Alfred Iten. The company will install a telephone system to extend from Waite Park to Five Points.

HOLDEN, MO.—The Holden Telephone Company has been incorporated with a capital stock of $50,000 by C. Bothwell, W. B. Wallace, C. E. Starkey, Joseph Greaves, C. L. Hobart and others.

SHERIDAN, MO.—Articles of incorporation have been filed for the Sheridan Farmers Telephone Company, with a capital stock of $3,000, by J. C. White, J. C. Merckling, S. W. Herndon, I. S. Tucker, John C. Harris and others.

STEVENSVILLE, MONT.—The Rural Telephone Company has been formed to install a telephone system in Stevensville, and is now in the market for material and equipment.

BOVINA CENTER, N. Y.—Articles of incorporation have been filed for the Bovina Center Telephone Company by John M. Miller, William T. Ward, Arthur D. Hoy, of Bovina Center, and others. The capital stock is placed at $3,000.

CLEMMONS, N. C.—The Muddy Creek Telephone Company has been incorporated with a capital stock of $10,000 by J. S. Hege, J. W. Hampton, J. D. Hill and others.

ROCKINGHAM, N. C.—The Richmond County Transit Company has been incorporated with a capital stock of $5,000 by T. L. Covington, W. R. Rand and A. S. Dockery.

CUYAHOGA FALLS, OHIO.—The Falls Heat, Light & Power Company has been incorporated with a capital stock of $10,000 by W. A.

Searl, S. D. Tifft, W. B. Middleton, C. A. Davis and C. K. Fowler. The company will operate under a franchise granted C. M. Walsh last fall.

McMINNVILLE, ORE.—The McMinnville Local Long-Distance Telephone Company has been organized by John Wortman, Leroy Lewis, George E. Wagoner, A. M. Peery, W. T. Macy and W. S. Houck. The company is capitalized at $20,000, and plans to erect a long-distance telephone line from McMinnville to Portville.

McVEYTOWN, PA.—The Ferguson Valley Telephone Company has been organized and the following named officers elected: John C. Shehan, president; L. H. Ruble, vice-president; Fred Swigart, secretary, and Charles Kauffman, treasurer.

ROMNEY, W. VA.—The Romney Telephone Company has been incorporated by C. P. Miller, D. A. Daugherty and others.

OSHKOSH, WIS.—The Oshkosh, Winneconne & Waupaca Railroad Company has filed articles of incorporation, with a capital stock of $100,000. The company proposes to build an electric railway from Oshkosh to Waupaca, a distance of 50 miles. The incorporators are William M. Bray, E. H. Steiger, Elmer Leach, Edward W. Murphy and L. J. Monahan, all of Oshkosh.

WAUPUN, WIS.—The Eastern Alto Telephone Company, of Alto, has been incorporated with a capital stock of $1,400. Following are the officers: D. V. W. Straks, president; John Freriks, vice-president; William Meenk, secretary, and Rudolph Kastein, treasurer.

BELLA COLLA, B. C., CAN.—The Bella Colla Telephone, Light & Power Company has been incorporated with a capital stock of $25,000.

COBURG, ONT., CAN.—The Alnwick Independent Rural Telephone Company has been organized in Alnwick Township. The officers of the company are: E. W. Hayden, of Roseneath, president; R. Campbell, vice-president; F. A. Aylesworth, secretary-treasurer.

CARNDUFF, SASK., CAN.—The Carnduff Telephone & Electric Company has been organized for the purpose of constructing a telephone system. The company is capitalized at $10,000, and the following directors have been elected: Dr. Lockhart, J. H. Elliott, E. J. Campbell, J. B. Preston and J. H. Taylor.

Legal.

NOT COMPELLED TO PURCHASE PLANT OR RENEW CONTRACT.—A decision handed down by Judge Graves in the Supreme Court at Topeka, Kan., on June 6, holds that the city of Clay Center, Kan., is not compelled to either buy the plant of the Clay Center Light & Power Company, or renew the franchise with the concern, according to the terms made by the City Council in 1886. The decision is a reversal of that of Judge Kimball, of the District Court.

ELECTRIC LIGHT COMPANY MUST EXERCISE HIGH DEGREE OF CARE AGAINST UNFORESEEN ACCIDENTS.—When on the public streets in a proper place one is injured, without fault on his part, by improper insulation or derangement of its appliances, a presumption of negligence arises which casts the burden on the defendant of showing that it exercised due care. In a recent action it appeared that, at the time of the injury, the plaintiff was a child of about 11 years of age. While on an errand it was necessary for her to pass one of the defendant company's poles, to which was affixed a guy wire and iron rod attachment, situated near a footpath at the edge of the place in the street where the sidewalk is usually placed. It had rained the night previous, the ground was muddy, and as she approached the guy wire and iron rod attachment her foot slipped on the soft ground, bringing her in contact with them. She immediately fell insensible to the ground, the guy wire being charged to a dangerous voltage, and on being rescued it was found that she had sustained permanent and lasting injuries, leaving her a helpless cripple. The company was held liable in damages. Shawnee Light & Power Company v. Sears, Supreme Court of Oklahoma, 95 Pac., 449.

FRANCHISE CANNOT BE OVER-RIDDEN BY ORDIANCE RAISING COMPENSATION.—At Memphis, Tenn., Chancellor Heiskell has dismissed the bill of the city of Memphis against the Cumberland Telephone & Telegraph Company, on the ground that the company had a valid contract with the city under which both had been reaping benefits for many years. The proceeding was an effort to collect $60,570, alleged to be due for pole rental. The city contended that the company owed pole rentals at the rate of $3 per annum for each pole in use in the city since 1902, basing its suit upon a recent decision of the United States Court of Civil Appeals. This decision held that the city had a right to charge pole rental, revising the decision of the federal court at Memphis, which held the rental to be uncollectible. The chancellor did not go into the reasonableness of the rental asked. The city had contended that no contract existed. The contract which is thus upheld was made in 1879. It gives the company the right to use the streets for planting poles on condition that the topmost cross-arm on each pole be kept in repair and held for the exclusive use of the city in operating its fire and police alarm system. The chancellor said that "the city of Memphis has been using this top cross-arm since the Carnes contract was made. While, as the city contends in this suit, the rights given the defendant under that contract have increased and become vastly more valuable than when given, it is also equally true that the city's consideration has also become more valuable, as its fire and police alarm system has been increased in proportion to the growth of the telephone company's business."

DUTY OF ELECTRIC COMPANY TO INSPECT BELTING.—It has been held that, while it is not the duty of an electric company to repair defects arising in the daily use of appliances, of a temporary character, not requiring the help of skilled mechanics where proper and suitable materials are supplied for repairs which may be easily made by the workmen, when a belt moving at the rate of 5000 ft. per minute passes within a half inch of a beam and girder, and the company employs a servant whose sole duty is to inspect the belts every morning and repair defects, and the others had nothing to do with the inspection, the company owes the duty of inspection and is liable for negligence of the servant selected to perform that duty. Where the facts show that, in the understanding of both parties, a class of ordinary repairs are to be made by the servants with materials furnished by the master for that express purpose; that they and he regard it as a detail of their own work; that it is something entirely within their capacity and not dependent upon the skill of a special expert, and that the necessity springs from their daily use of the appliance, occurs at different and unknown periods in their service and is open to their observation in the absence of the master, the inference is inevitable that the contract relation between the parties makes it a duty of the servants and a detail of their work to correct the defect when it arises with the materials furnished. It was held that the present case did not fall within the exception, and a judgment in favor of the plaintiff was reversed on appeal. Dittman v. Edison Electric Illuminating Co., New York Supreme Court, Appellate Division, 110 N. Y. Supp., 87.

Obituary.

MR. W. H. YOUNG.—William Hamilton Young, of Washington, D. C., one of the most widely known telegraphers in the country, died suddenly at the home of his son Frank, in Chicago, June 19. Mr. Young, who was night manager of the Western Union Telegraph Company's Washington office for 30 years, had gone to Chicago to take charge of the press matter of the Washington correspondents during the Republican national convention last week, and while on duty at the Coliseum was overcome by the heat. Mr. Young was 73 years old. He became a telegraph operator at the age of 20 and in the Civil War was employed by the government at Washington, where part of his duties was to censor press despatches. In addition to his work as night manager, he had charge of the Western Union's press telegraphis service at the Capitol during the sessions of Congress for the last 25 years. His mildness of manner and courtesy made him extremely popular among newspaper men and senators and congressmen in Washington. Among his friends he was familiarly known as "Ham" Young, and he was highly esteemed by telegraphers throughout the country. At the time of his death he was vice-president of the Telegraphers' Mutual Benefit Association, which office he had held for many years; and two years ago he was president of the Old Time Telegraphers' Association.

Personal.

MR. EMERSON McMILLAN, of New York City, has been elected trustee of Cornell University.

PROF. V. KARAPETOFF, who has been assistant professor of electrical engineering at Cornell University, has been promoted to a full professorship.

MR. T. F. SALTER, who has made a specialty of that branch of engineering dealing with hoisting and conveying apparatus, has been appointed chief engineer of the Standard Roller Bearing Company of Philadelphia.

MR. RICHARD M. JACKEL, formerly employed at the Ft. Wayne Electric Works, Fort Wayne, Ind., has recently been appointed superintendent of the Reynolds Electric Flasher & Manufacturing Company, of Chicago, Ill.

MR. G. W. HART, of the Hart Manufacturing Company, Hartford, Conn., manufacturer of "Diamond H" switches, sailed for Europe on the *Adriatic* June 17, to be absent until September. He was accompanied by Mrs. Hart and Master George Hart.

MR. L. A. FERGUSON, vice-president of the Commonwealth Edison Company, Chicago, addressed the Chicago Electric Club at its noonday meeting June 17 on "The Relationship Between the Engineering and Commercial Departments of Electrical Undertakings." His address was along the line of that given at the recent N. E. L. A. convention.

MR. JOHN S. BARTLETT, formerly vice-president of the Lynn Gas & Electric Company, of Lynn, Mass., has been appointed president of the company to succeed the late Mr. Charles H. Newhall. Mr. Eugene B. Fraser, treasurer, has been elected to the vacancy on the board of directors. Mr. Charles H. Pritchard, vice-president, will also assume the duties of general manager of the company.

MR. LEWIS M. McBRIDE, who has been connected with the electrical industry in various branches and as electrical engineer for several concerns, and Mr. Robert B. Bonney, who has been engaged in technical telephone and electrical work for the past twelve years, have entered the electrical engineering field under the firm name of McBride & Bonney, with offices in the Jackson Block, Denver, Col., and will undertake the complete installation of lighting and power plants and electrical and telephone equipment.

MR. RAYMOND LESTER BROWN, of Campville, Conn., received

upon graduation the prize for excellence in electrical engineering, which is annually awarded by the Sheffield Scientific School, of Yale University.

MR. E. M. GREEN has been appointed superintendent of the Blue Ridge Light, Power & Railway Company, of Staunton, Va.

MR. WILLIAM HAND BROWNE, JR., formerly of Baltimore, Md., and a graduate of Johns Hopkins University, has been appointed professor of electrical engineering in the North Carolina Agricultural and Mechanical College, at Raleigh, N. C. Mr. Browne for some years has been technical editor of *Electrical Review*.

MR. GEORGE WILLIAMS, commercial engineer for H. L. Doherty & Company, was married on June 20, to Miss Christine Dahl, of Christiana, Norway. The ceremony was performed in Scranton, Pa., and the couple left immediately for Buffalo and Cleveland. Mr. and Mrs. Williams will take up a permanent residence in New York City.

Trade Publications.

HAND TOOLS, including screw-drivers and drills are well discussed in an illustrated booklet issued by the North Bros. Mfg. Co., Philadelphia, Pa.

ELECTRIC SPECIALTIES.—The Gillette-Vibber Company, New London, Conn., has issued a bulletin descriptive of its molding boxes and cable caps.

LIGHTING SPECIALTIES.—Bulletin No. 54, of the H. T. Paiste Company, Philadelphia, Pa., deals with ground-clamps, entrance-switches, tablets and receptacles.

AIR PUMPS driven by direct-current on alternating-current motors are described in Bulletin No. 3803 of the Emerson Electric Manufacturing Company, St. Louis, Mo.

FIRE EXTINGUISHERS of the chemical type are briefly described and illustrated in a folder issued by the H. W. Johns-Manville Co., 100 William Street, New York.

STEAM SPECIALTIES, including gage cocks, water gages, gate valves, bronze and brass fittings are described in catalogue F of the Ohio Brass Co., Mansfield, Ohio.

STORAGE BATTERIES for telephone service are thoroughly treated in an instructive manner in Bulletin No. 103 of the Electric Storage Battery Company, Philadelphia, Pa.

STORAGE BATTERIES, which are claimed to be "fool-proof," are described in a catalogue issued by the Haschke Storage Battery Company, 271 Michigan Avenue, Chicago, Ill.

COMPOUND ENGINES.—The American Engine Company, Bound Brook, N. J., has issued bulletin No. 14, dealing with compound engines for direct-connected and belted services.

ELECTRICAL SPECIALTIES, including plugs, rosette cleats and receptacles are listed and described in a catalogue issued by the Tregoning Electric Mfg. Company, Cleveland, Ohio.

DIRECT-CURRENT MOTORS rated at from 0.25 hp to 0.50 hp are illustrated and described in Bulletin No. 3212 of the Emerson Electric Manufacturing Company, St. Louis, Mo.

RAILWAY GENERATORS of the direct-current type rated at from 125-kw to 1000-kw, are fully described in bulletin No. 104 of the Crocker-Wheeler Company, Ampere, N. J.

LIGHTNING ARRESTERS of the non-arcing type for electromotive forces up to 66,000 volts are discussed in Bulletin E of the Lord Electric Company, 213 West Fortieth Street, New York.

SEWING-MACHINE MOTORS, of the direct-current and alternating-current types are illustrated and described in bulletin No. 3905, of the Emerson Electric Mfg. Company, St. Louis, Mo.

BOILER-CLEANING COMPOUND.—Information concerning Magic boiler-cleaning compound is given in a booklet isued by the H. W. Johns-Manville Company, 100 William Street, New York.

ELECTRIC FANS.—Direct-current and alternating-current fans for ceiling and desk use are well illustrated in a descriptive booklet issued by the Dayton Fan & Motor Company, Dayton, Ohio.

TELEPHONES.—Pamphlet No. 6 of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., is devoted to magneto telephone switchboards and self-restoring gravity-drop signals.

ELECTRIC FANS for desk, ceiling and column use are well discussed in a neat folder, No. 4101, of the Westinghouse Electric & Mfg. Company, Pittsburg, Pa. The motors are of the direct-current type.

TRANSFORMERS.—The Wagner Electric Mfg. Company, St. Louis, Mo., has distributed mailing cards calling attention to its lines of transformers, motors and electrical measuring instruments.

SWITCHBOARDS.—In its bulletins Nos. 96 and 102, the Crocker-Wheeler Company, Ampere, N. J., gives detailed information concerning alternating-current switchboard panels for 1150 or 2300 volts.

DIRECT-CURRENT MACHINES.—Motors rated at from 50-hp to 275-hp and generators rated at from 45-kw to 225-kw are discussed in bulletin No. 101 of the Crocker-Wheeler Company, Ampere, N. J.

ELECTRICALLY-OPERATED DRILLS AND GRINDERS are illustrated and described in a bulletin issued by the Armorduct Manufacturing Company, Ltd., Farringdon Avenue, London, E. C., England. These tools are of either the polyphase induction or direct-current series type.

VENTILATING FANS.—An interesting article on ventilating fans, which first appeared in *The Engineering Magazine*, has been reprinted in bulletin No. 153 of the B. F. Sturtevant Company, Hyde Park, Mass.

MOTOR DRIVER.—In its bulletin entitled "Drive No. 3," the Peerless Electric Company presents some convincing arguments as to the advantages of electric motor drives in general and Peerless drives in particular.

SOUND DEADENER.—The H. W. Johns-Manville Company, 100 William Street, New York, has issued a folder calling attention to its hair insulator, which is used for preventing the transmission of heat, cold or sound.

"ELECTRICITY IN MINES" is the title of a neatly-executed bulletin issued by the British Thomson-Houston Company, Ltd., Rugby, England. Both direct-current and alternating-current motor installations are described and illustrated.

SWITCHES.—Publication No. 570, of Verity's, Ltd., Aston, Birmingham, England, is devoted to switch-gear and switchboards. Illustrations and descriptions are given of switches, fuses, iron-clad material, switchboard material, switchboards, starters and regulators.

BOILER TUBE CLEANERS.—Catalogue G, of the Lagonda Mfg. Company, Springfield, Ohio, describes briefly turbine and mechanical boiler-tube cleaners, reseating machines for cleaning nuts, heads and caps of boilers, boiler-tube cutters and automatic cut-off valves.

VENTILATING FANS driven by direct-current motors are treated in bulletin No. 90 of the B. F. Sturtevant Company, Boston, Mass. Bulletin No. 97 deals with ventilating sets of both the portable and convertible types. Propeller fans are well described in bulletin No. 146 of the same company.

ROLLER BEARINGS.—Bulletin No. 31 of the Hyatt Roller-Bearing Company, Newark, N. J., is a well-executed publication dealing with roller-bearing bushings. There are now offered to the trade more than 300 sizes of standard Hyatt bearings, each provided for a special condition of speed and load.

SINGLE-PHASE INDUCTION MOTORS.—In a booklet entitled "Vox Populi," the Wagner Electric Mfg. Co., St. Louis, Mo., presents convincing evidence that its single-phase induction motors have given satisfaction by printing numerous letters from customers that have used its motors for many years.

HYDRO-ELECTRIC DEVELOPMENT.—Bulletin No. 103, of the Crocker-Wheeler Company, Ampere, N. J., contains a well-prepared and appropriately illustrated description of the hydro-electric development made by the Sanitary District of Chicago, on the drainage canal where a 16,000-hp equipment has been installed.

TUNGSTEN LAMP FIXTURES designated as luminiers are dealt with in bulletin No. 1 of the Cleveland Gas & Electric Company, Cleveland, Ohio, and in Vol. 1, No. 7, of *Holophane*, issued by the Holophane Company, 227 Fulton Street, New York. The latter publication also describes so-called "Lexoliers"—fixtures for tungsten lamps.

MOTORS IN PRINTING ESTABLISHMENTS.—Bulletin No. 5910-5, the Western Electric Company, Chicago, Ill., contains much interesting and valuable information concerning the use of motors for driving printing machinery. An imposing list of printing offices where Western Electric equipments are used is also included.

VERTICAL SHAFT DIRECT-CURRENT MOTORS.—Roth Bros. & Co., Chicago, have just compiled a new bulletin No. 181, containing information and data relating to vertical shaft motors of their manufacture. One of the advantages of this type of motor is that it is particularly adaptable for displacing bevel gears and complicated drives.

ELECTRICAL SUPPLIES, including insulated wires and cables, conduits and fittings, outlet boxes, conduits, switches, fuses, panels, sockets, rosettes, tape, tungsten and carbon lamps, shades, fixtures, heating devices, electric fans, etc., are listed and described in the 1908 catalogue of the Zenco Electrical Supply Company, 94 West Van Buren Street, Chicago, Ill.

INDUCTION MOTORS FOR SHOP DRIVE.—The Wagner Electric Manufacturing Company, St. Louis, Mo., has issued a well-illustrated bulletin devoted to the machine-tool equipment of the shops of the Wabash Railroad Company, at Decatur, Ill., where 440-volt, three-phase induction motors are used throughout. A particularly valuable feature of the bulletin is a complete list of the motors that have been selected for driving the individual machines and groups of machines.

VARIABLE SPEED MOTORS.—The Lincoln Motor Works Company has issued Bulletin No. 10 containing a full description of its variable speed motors, including detail drawings, speed and efficiency charts, table of ratings, etc. The bulletin describes fully the principle of operation of the company's type of motor and its peculiar advantages for all forms of individual drive requiring adjustable speeds. A few illustrations showing the applications of motors to machine tool drive are also included.

SINGLE-PHASE INDUCTION MOTORS.—Bulletin No. 3124, of the Emerson Electric Mfg. Company, St. Louis, Mo., is devoted to single-phase induction motors of the self-starting split-phase type rated at from 16-hp to 25-hp. These motors will start from rest under full-load torque. Motors of the same general type designed for starting under less severe conditions are described in bulletin No. 3125, while bulletin No. 3126 deals with motors similar to the above but rated at from .25-hp to .50-hp.

ENGINEERING SPECIALTIES.—The Schutte & Koerting Co., Philadelphia, has issued a new catalogue in three sections. One section relates to apparatus for the chemical industry; one to apparatus, steam and engineering specialties for use in power plants, etc., and a general catalogue illustrative and descriptive of their entire line.

G. E. FLAME ARC LAMP.—The General Electric Company, Schenectady, N. Y., describes in Bulletin No. 4586 a new lamp containing many novel mechanical features and of particularly simple construction. The lamp is of short length, being only 31 inches from top to bottom, and is intended for operation either in series or in multiple. Among some of the advantages are the elimination of clock mechanism, accessibility of parts when the shell is lowered to the trimming position and many special features of reliability inherent in the design.

INCANDESCENT LAMPS.—A publication that should be in the files of every illuminating engineer and every one interested in lighting is Bulletin No. 7, of the Buckeye Electric Company, Cleveland, Ohio, which gives much reliable data relating to the candle-power and illumination obtained from the numerous forms of commercial illuminants, together with information concerning color effects, reflection from walls, and economy in the use of high-efficiency lamps. Bulletin No. 3 of the same company deals with the Gem carbon-filament lamp, which has a specific consumption of 2.5 watts per candle.

INDUSTRIAL PLANT.—W. S. Barstow & Company have just issued a neat and attractively illustrated bulletin, which is the first of a series describing plants typical of certain classes of work. The bulletin describes the plant and work of reconstruction of the Jamestown Worsted Mills. This establishment is typical of others which have grown up about a boiler and engine room and have become hampered with the difficulties of mechanical drive and so cramped for space as to be forced to install the more flexible system of electric motor drive. The equipment of the power plant was changed from low-pressure steam boilers and Corliss engines to high-pressure steam boilers and steam turbo-generator units, without in any way crippling the output during the period of reconstruction.

ELECTRICALLY HEATED HOUSEHOLD APPLIANCES.—The General Electric Company, Schenectady, N. Y., has issued a handsome pamphlet describing briefly its line of electric heating and cooking devices. The illustrations show flatirons of various types, water heaters, combination cereal cookers, tea kettles, percolators, chafing dishes, stoves, frying pans, grids, ovens, etc. Cooking and baking outfits, consisting of combinations of the most desirable apparatus, are also described, and such specialties as cigar lighters, shaving mugs, heating pads, corn poppers, etc., have their place in the booklet. New designs of luminous radiators and tubular air radiators are given. The booklet contains complete lists of catalogue numbers, with ratings, capacities, voltages, prices, etc., and forms a very satisfactory reference book of the present state of electric heating and cooking.

RAILWAY MOTORS.—Bulletin No. 4588, just issued by the General Electric Company, Schenectady, N. Y., describes the GE-202 railway motor, which is similar in design and construction to the latest standard GE railway motors, containing all their improvements and, in addition, being provided with commutating poles. The characteristics of the commutating-pole motor allow the overload to be considerably increased and at the same time a more rugged form of motor is obtained which will withstand the most severe service conditions and is less likely to be injured by misuse. The motor is, therefore, especially adapted for operation on heavy grades or with equipments geared for high speed work which have also to start and stop frequently in city service. The details of construction are given at some length in the bulletin, and an interesting article on rating, with suggestions for the proper selection, is included. Dimension diagrams, characteristic curves and a service data sheet for use in ordering complete the pamphlet.

TUNGSTEN ECONOMY DIFFUSERS.—Under the name of the "Tungsten Economy Diffuser" the General Electric Company, Schenectady, N. Y., is placing on the market a new form of illuminating device, which is described in Bulletin No. 4594. The two types described are designated respectively as the store type and mill type. They consist of a broad reflector or diffuser surrounding a frosted globe containing the lamps; they are made for five or six lamps and can be adjusted for tungsten, tantalum or carbon filament incandescent lamps in all the usual sizes. A special snap switch has been developed which allows different combinations of the lamps to be made with convenience. The bulletin contains photometric curves showing the light distribution under different combinations, connections and data as to the different styles manufactured.

ALUMINUM LIGHTNING ARRESTERS.—Bulletin No. 4595 of the General Electric Company has for its subject Form I, now being placed on the market. The arrester consists of a "stack" of concentric, inverted aluminum cones, insulated from each other and placed in a tank of oil. Before being placed in the oil the space between the cones is partially filled with a special electrolyte. The critical value at which the electrolyte breaks down is 420 volts for any two adjacent cones, and when this potential is reached the action is similar to that of a safety valve and a large amount of current allowed to flow during discharge. This action is produced by a thin film which forms on the aluminum plates by electrolyte action, and as soon as the discharge ceases the film immediately reforms. Illustrations of lightning arresters for different capacities, diagrams of dimensions and connections and other data are given in the bulletin, which is of timely interest to the managements of electrical installations.

Unclassified Items.

(Items received too late to classify under Construction News, etc.)

LAWRENCEBURG, TENN.—The city has purchased a 250-kw water wheel type alternator and exciter of the Allis-Chalmers Company, of Milwaukee, Wis., for the municipal electric light plant.

PRATT, KAN.—The Pratt Light & Ice Company has recently purchased of the Allis-Chalmers Company, of Milwaukee, Wis., a 100-kw and a 50-kw generator with exciters and a 50-hp motor.

ELBERON, N. J.—The New Jersey Consoliated Water & Light Company has placed an order with the Allis-Chalmers Company, of Milwaukee, Wis., for a 175-kw belted generator for its plant at Elberon.

WILLIAMSPORT, PA.—The Citizens' Electric Company will install a 300-kw engine-type, Allis Chalmers generator unit in its plant.

NORTHAMPTON, MASS.—The Northampton Electric Lighting Company has recently placed an order with the Allis-Chalmers Company, of Milwaukee, Wis., for a 250-kw, three-phase, 2300-volt, 60-cycle elternator and a 6-kw, belt-driven exciter set to furnish electrical energy for the recently extended street lighting system.

SAND POINT, IDAHO.—The Pend d'Orielle Electric Company has recently placed an order with the Allis-Chalmers Company, of Milwaukee, Wis., for a 225-kw engine-driven set with exciter and switchboard.

HARTFORD, WIS.—The City Council has decided to build a municipal electric light plant, the cost not to exceed $27,000. The plans provide for a 30 and 60-kw, 2300-volt, 60-kw, single-phase, alternating-current generators.

BEULAH, WYO.—Contracts have been awarded for excavating the canal and tunnels on the Sand Creek Canal to be constructed by Henry Keats and others, of Spearfish. The canal will furnish 1800-hp for operating an electric power plant at Beulah, which will furnish electricity to operate the mines in the Black Hills.

WAHOO, NEB.—Bids will be received until July 6 at the office of L. H. Lytle, city clerk, for furnishing machinery and apparatus and installing complete an electric light and water works system for the City of Wahoo. E. Lehmkuhl is mayor.

ALBANY, MINN.—The citizens are contemplating installing a municipal electric light plant, the cost not to exceed $3,500.

CHADWICK, ILL.—The village contemplates the purchase of a new engine for the municipal electric light plant. Asa Rogers is manager.

WAYNESBORO, PA.—New machinery is being installed in the substation of the Chambersburg, Greencastle & Gettysburg & Waynesboro Street Railway Company at Marion. The equipment consists of transformers, generators, etc. The extension from Greencastle to the county seat is nearly completed.

DAVENPORT, IA.—The Tri-City Railway & Light Company is contemplating the addition of a steam heating plant to its system.

HARTFORD, WIS.—The citzens have noted in favor of issuing $27,000 in bonds for the construction of a municipal electric plant to furnish electricity for commercial lighting as well as for street lamps.

NATCHEZ, MISS.—The contract for street lighting has been awarded to the Southern Light & Traction Company for a term of five years at the rate of $90 per lamp per year, which is a reduction of $13 per lamp on the price now paid by the city for street lamps. The street lighting system consists of 119 lamps. L. H. Dinkins is president of the company.

HELENA, MONT.—Plans are being made for the rebuilding of the Hauser Lake Dam of the Helena Power Transmission Company, which was recently washed away by the flood. Contracts for the work will soon be let; also for the construction of the new dam at Wolf Creek, which will make the third large dam the company owns on the Missouri River.

JERSEY CITY, N. J.—The Mutual Benefit Electric Light & Power Company announces that it will apply again to the Board of Aldermen for another franchise. The company was recently granted a franchise by the Council, which was vetoed by the Mayor.

ST. PAUL, MINN.—The Northern Heating & Electric Company has absorbed the plant and holdings of the Union Manufacturing Company, which has a franchise to supply the Midway District with electricity for lamps.

RICHMOND, UTAH.—The High Creek Electric Light & Power Company contemplates extending its transmission lines in the different towns covered by its system. The cost of the work is estimated at about $5,000.

ELIZABETHTOWN, PA.—The Elizabethtown & Florin Street Railway Company is contemplating the construction of a new power house, which will probably be located at either Tunnel Hill or at Rheems. Contracts for the construction of the power house will soon be let.

PATTON, PA.—The directors of the Northern Cambria Street Railway Company have decided to extend its railway from Barnesboro to Hastings, a distance of between four and five miles. James T. McNellis is superintendent.

ST. CLOUD, MINN.—Articles of incorporation have been filed for the Union Electric Power Company with a capital stock of $100,000. The company proposes to install an electric power plant in St. Cloud. The directors are A. G. Whitney and others.

HARDIN, MONT.—The Hardin Water & Power Company has been incorporated with a capital stock of $30,000, by Carl Rankin and others.

NEWPORT, ARK.—The People's Light, Water & Power Company has been incorporated with a capital stock of $25,000, by F. R. Suits, George O. Beebe and Henry Baldus.

Business Notes.

THE STANDARD ROLLER BEARING COMPANY, of Philadelphia, announces a further expansion of its sales organization by the opening of a branch office at 327 Jefferson Avenue, Detroit, in charge of Ernest L. Smith, recently appointed Western representative.

COOK WIRE JOINTS.—Frank B. Cook, Chicago, has received a large order for self-welding wire joints from the U. S. Government for use on transmission lines being installed in connection with reclamation work in the Northwest and Southwest. He has also closed a contract to supply wire joints to the Manitoba Government.

AUTOMOBILE IGNITION SUPPLIES.—The Manhattan Electrical Supply Company, 17 Park Place, New York, has just issued a 12-page folder showing the line of automobile supplies it manufactures, including spark coils, switches, battery connector, etc. A revised edition of its pocket size catalogue, 168 pages, "Something Electrical for Everybody," is also ready for distribution.

THE TRACY ENGINEERING COMPANY, formerly of 66 Beaver Street, New York City, has removed its headquarters from New York to Los Angeles, Cal. The company's offices will be in the Central Building, and in order not to conflict with a company of the same name already in Los Angeles, the name of the company has been changed to Blythe-Tracy Company. The new company is new in name only, and will continue the business formerly conducted by the Tracy Engineering Company, of New York City.

GAS ENGINES IN THE OIL FIELDS.—In the oil fields they are running gas engines twenty-four hours a day, seven days in the week, using Edison primary batteries, and engineers do not have to look to their ignition oftener than once or twice a year. Then a few minutes are required to renew the cells which at once become the same as new cells. The men in the oil fields praise the inventive genius of Thomas A. Edison whenever the ignition question is brought up. His primary batteries and spark coil are now met with on every hand.

DOSSERT CONNECTORS.—The Rio de Janeiro Tramway, Light & Power Company, Ltd., of Rio de Janeiro, Brazil, has received a large shipment of Dossert 2-way joints comprising 25 for 500,000 circ. mil. cable, 100 for 250,000 circ. mil. cable, 100 for No. 00 cable and 50 for No. 0 cable, from Dossert & Company, 242-244 West Fort, first Street, New York City. The order was placed through the New York office of the Rio tramway company. Additional large orders have been received for Dossert solderless 2-way connectors to be installed in the junction boxes used in the wiring of the new steel passenger cars now being completed by the Pressed Steel Car Company at McKees Rocks, Pa., for the Pennsylvania Railroad.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 16, 1908.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

890,592. PROTECTIVE DEVICE FOR HIGH-POTENTIAL SYSTEMS; Richard Apt, Berlin, Germany. App. filed Aug. 17, 1906. The combination of a grounded receptacle, a column of liquid communicating therewith and connected to a line conductor of an electrical system, and a second liquid column of lower resistance connected between said receptacle and said line conductor through a spark gap.

890,593. SYSTEM OF DISTRIBUTION; Albert H. Armstrong, Schenectady, N. Y. App. filed Sept. 13, 1907. In a railway system operated by alternating current, a trolley wire, a catenary suspension therefor and means for maintaining the catenary at a potential approximately equal but opposite to that of the trolley wire.

890,601. WINDING MACHINE; John G. Callan, Lynn, Mass. App. filed Jan. 19, 1905. Complete organized machine for automatically winding armatures of the type employed in electric meters of the motor type. Includes electrical stop motion devices which act at the completion of the various armature coils.

890,607. RAILWAY SIGNAL; Abra G. Clark, Schenectady, N. Y. App. filed Oct. 14, 1907. A quick break switch for controlling the driving motor of a semaphore signal. Makes use of a pair of spring blades which project into the path of a segment contact on the semaphore arm.

890,615. AUTOMOBILE; Albert G. Davis, Schenectady, N. Y. App. filed Feb. 8, 1904. Relates to complete features of a circuit controller for the transmission system of an automobile having a dynamo and a motor in alignment with one another in place of the usual transmission shaft.

890,617. ALTERNATING-CURRENT MOTOR; Max Deri, Vienna, Austria-Hungary. App. filed Dec. 16, 1902. In an alternating-current motor, a primary winding adapted to be connected to a source of current, a secondary winding provided with a commutator and brushes in inductive relation thereto, a transformer having its primary connected in series with one of said windings, and a magnetizing winding connected to the secondary of said transformer.

890,621. CIRCUIT CONTROLLING DEVICE; George H. Dorgeloh, Schenectady, N. Y. App. filed Oct. 5, 1907. Means whereby an electric motor may be stopped, started and generally controlled by a contact arm moving over segment contacts. Includes means by which the motor may be run at different speeds for use with printing presses and the like.

890,622. SYSTEM OF MOTOR CONTROL; Edgar F. Dutton, Schenectady, N. Y. App. filed Feb. 21, 1907. Has an electric motor and a controlling switch, a source of mechanical power and reversible gearing between the source and the switch, and means for controlling the gearing from a distance so as to drive the motor controlling switch in either direction to control the motor.

890,627. MOTOR CONTROL; Friedrich Eichberg, Berlin, Germany. App. filed Jan. 23, 1907. In combination with an alternating-current motor and a source of current therefor, a transformer having its primary winding connected to the source, a second transformer having its secondary winding connected to the motor, and means for connecting the other two windings of the two transformers to different points on each other.

890,638. VARIABLE VOLTAGE TRANSFORMER; Edward F. Gehrkens, Schenectady, N. Y. App. filed July 26, 1906. Variable voltage transformers of the type comprising a magnetic core, with primary and secondary coils thereon, and two movable magnetic members, one arranged to open the magnetic circuit threading both the primary and secondary coils and the other to close a magnetic circuit outside of the secondary coil.

890,661. TELEGRAPHY; Isidor Kitsee, Philadelphia, Pa. App. filed Apr. 23, 1906. A means by which telegraphic messages may be received simultaneously at a series of stations connected in one circuit by the method of reversals.

890,664. TROLLEY WHEEL; Thomas Langen, Brooklyn, N. Y. App. filed April 8, 1907. The trolley wheel is made in separable sections, including side flanges and a central removable tread, which are held in place by a threaded tubular core.

890,670. CIRCUIT CLOSER FOR AUTOMATIC TRAIN STOPS; Joseph H. Lynch, Red Bank, N. J. App. filed May 2, 1907. Has a horizontally and vertically movable shoe on a vehicle and a specially constructed tappet device adapted to exert a composite cam function to impel the shoe laterally or vertically, as desired.

890,679. LIGHTNING ARRESTER; Ezra B. Merriam, Schenectady, N. Y. App. filed Nov. 8, 1906. A protective device having means for establishing a water jet to carry discharges from the line conductor and means for confining the expansion action of the water when a heavy discharge is transmitted thereby.

890,695. COMBINED SIGNAL AND SPRING-JACK; James L. McQuarrie, Oak Park, Ill. App. filed May 5, 1906. The combination with an electromagnet of a rocking arm pivoted intermediate its ends, a curved armature carried by one end of said arm in position to be attracted by said magnet to rock the arm, a signal carried by the opposite end of said arm and displayed when the arm is rocked, a catch for holding said armature in its attracted position, a spring-jack and a plug adapted when inserted in said spring-jack to release said catch.

890,697. PROTECTIVE DEVICE FOR UNIPOLAR MACHINES; Jakob E. Noeggerath, Schenectady, N. Y. App. filed Oct. 4, 1905. The patentee arranges a protective device for each of the stationary cross connections for the armature conductors of a unipolar generator.

890,699. METHOD OF OPERATING INDUCTION MOTORS; Robert H. Parker, Schenectady, N. Y. App. filed Dec. 4, 1905. The method of operating synchronously an induction motor having both rotor and stator coil-wound, which consists in producing two rotating fields in said motor, one rotating at synchronous speed with respect to the stator and the other rotating in the opposite direction at a speed with respect to the stator corresponding to the slip of the rotor below synchronous speed.

890,718. CIRCUIT BREAKER; Arthur Smith, Schenectady, N. Y. App. filed April 24, 1906. Relates to circuit breaker switches of the type operated by solenoids and controlled at a point remote from the main switch. Provides an indicating device which is actuated under certain abnormal conditions.

890,719. MOTOR STARTING PANEL; Arthur Smith, Schenectady, N. Y. App. filed Jan. 17, 1907. A means for controlling electric motor circuits, having a device whereby the main armature circuit is automatically opened by means external to the controlling device itself.

890,722. REGULATION OF DYNAMO ELECTRIC MACHINES; Charles P. Steinmetz, Schenectady, N. Y. App. filed Jan. 31, 1906. The combination of a dynamo electric machine, having a multiphase exciting winding and a multiphase generating winding, a low frequency exciting circuit connected to said exciting winding, resistances in said exciting circuit and means responsive to the voltage of said generating winding for controlling said resistance.

890,730. VARIABLE VOLTAGE TRANSFORMER; Matthew O. Troy, Schenectady, N. Y. App. filed July 26, 1906. Construction of variable voltage transformer, having a pair of movable members, one of which is pivoted to vary the reluctance of the magnetic circuit and the reluctance of a magnetic shunt for the secondary winding.

890,731. STARTING MERCURY-VAPOR APPARATUS; Matthew O. Troy, Schenectady, N. Y. App. filed Sept. 27, 1907. A means for starting mercury vapor lamps, comprising a starting device in which the starting is produced through the action of a heated surface, preferably oxid coated, in the vicinity of the cathode.

890,737. VARIABLE RESISTANCE COIL; Herbert A. Wallace, New York, N. Y. App. filed Aug. 9, 1907. Makes use of a cylindrical winding engaged by a pair of sliding spring contacts which are adjusted upon the cylinder by a thumb screw.

890,763. ARC LAMP; Richard Fleming, Lynn, Mass. App. filed May 18, 1904. Covers features of the feeding mechanism and means for disposing of the fumes from the arc and for ventilating the lamp mechanism.

890,770. FIXED POLARITY SEPARABLE ATTACHMENT PLUG; Harvey Hubbell, Bridgeport, Conn. App. filed Sept. 5, 1907. A separable attachment plug for high potential electrical service, so constructed that the parts can be attached in one way only, thereby fixing the polarity and preventing reversal of the current.

890,776. DAMPER FOR THE UPPER HARMONICS OF ALTERNATING ELECTRIC CURRENTS; Maurice Le Blanc, Paris, France. App. filed April 28, 1905. An alternating-current machine provided with an unscreened very high resistance harmonic-damper circuit, substantially as described.